NOVEMBER · 1953
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

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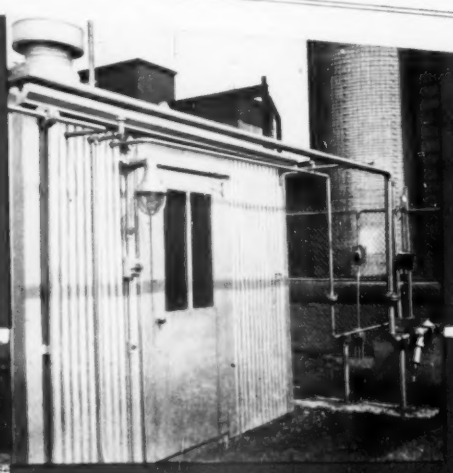
but our 28,000 subscribers — *Electrical Contractors, Heads of Electrical Departments in Plants and Other Large Buildings, Electrical Consultants and Motor Service Shop Owners*—spend approximately $66,000 annually to receive this monthly editorial service. It helps them do their jobs better. And as you page through this issue you'll see why and how.

WIRING METHODS for *petro-chemical plant installations.*

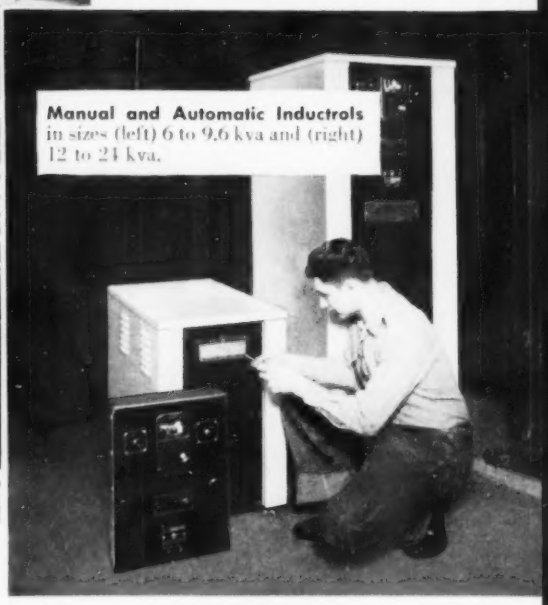


DUAL FEEDER system serves new Connecticut propeller plant.

A McGRAW-HILL PUBLICATION | 53RD YEAR

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

FLUORESCENT LAMPS need constant voltage for maximum operating efficiency and lamp life.



Manual and Automatic Inductrols in sizes (left) 6 to 9.6 kva and (right) 12 to 24 kva.

Maximum equipment life—less operating cost with G-E voltage regulators

You can eliminate the harmful effects of undervoltage and overvoltage on your a-c electric equipment by installing G-E Inductrols. These dry-type regulators automatically maintain correct voltage and insure peak operating efficiency.

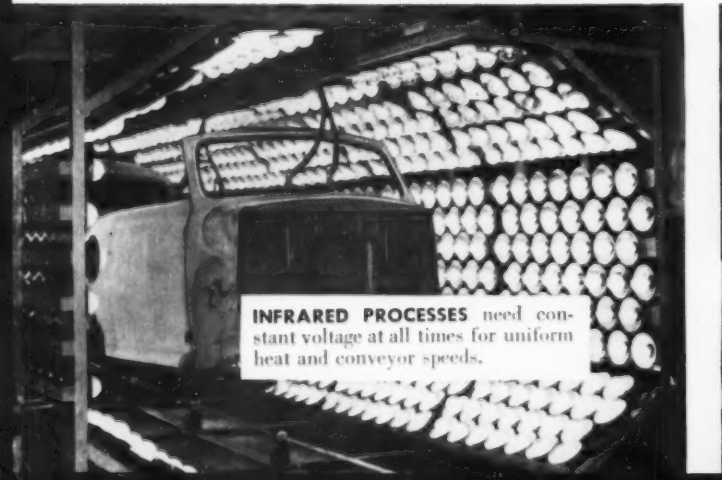
Standard automatic regulators are available for circuits from 3 kva, 120 volts up to 520 kva, 600 volts either single- or three-phase. For more information, contact your nearest G-E Sales Representative, or write for Bulletins GEA-5824, GEC-795 and GET-2351. General Electric Company, Section 423-202, Schenectady 5, New York.

You can put your confidence in—

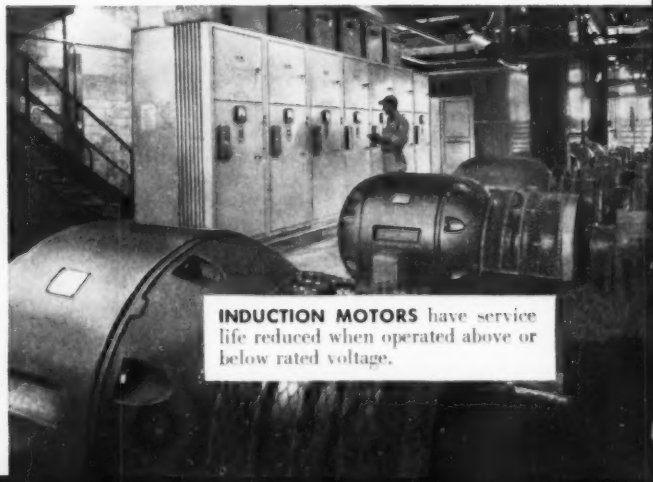
GENERAL ELECTRIC

WHY YOU NEED GOOD VOLTAGE

EQUIPMENT	10% UNDERVOLTAGE	10% OVERVOLTAGE
INCANDESCENT LAMP BULBS	Cuts light output 30% —slows production	Cuts life 70%—triples costs
A-C MOTORS	Overheat—ups maintenance costs	Lowers power factor —ups power costs
RESISTANCE HEATERS	Cuts heat output 19% —slows production	Overheats—ups replacement costs
ELECTRONIC DEVICES	Probably destroy gas-filled tubes	Only 5% over cuts tube life 50%
INFRARED PROCESSES	Ups process time —slows production	Blisters, scorches—ups production cost



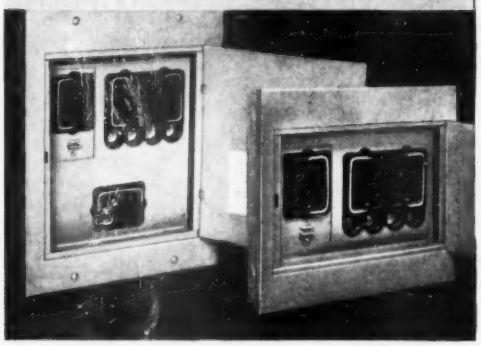
INFRARED PROCESSES need constant voltage at all times for uniform heat and conveyor speeds.



INDUCTION MOTORS have service life reduced when operated above or below rated voltage.

NEW MURRAY "PJ" LINE CUTS COSTS...SAVES TIME!

MURRAY FUSIBLE "PJ" LINE OF SIX BASIC DISTRIBUTION PANELS



This 60-amp fusible equipment comes with 3 or 4 pull-outs and 4, 6 or 8 branch circuits, in series or parallel. Handles almost any load combination. Panels have dead front construction, are finished in attractive baked-on grey Melamine. Famous Murray quality throughout.

Everything: Main, Lighting & Appliance, and Power circuits—complete in one compact box. Everything goes up at one time. Note special sealable compartment containing one pullout—ideal for separate rate off-peak water heating. Barrier removable when not required.

. . . helps you meet increased loads at decreased costs!

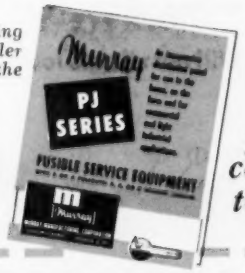
The attractive, low-cost PJ line is designed to help you handle increased loads on home, farm and commercial jobs with a minimum of equipment. With only six basic panels you get full-line versatility for almost any combination of light, appliance and power circuits. Minimum-stock line also means easier ordering and stocking for you.

. . . saves you more time and money on installation!

Putting up PJ panels is clean, fast work with installation time cut to the bone. There are plenty of clean-cut, easy-to-remove KO's just where you want them. Plenty of knuckle room, too. And no wire fumbling—you'll find high quality solderless connectors on all terminals conveniently located. Surface hook-on cover saves extra time.

In every way, Murray PJ panels are ideal for low-cost installations. Your Murray wholesaler has them now. Lay in a supply today and be ready for any job that comes along.

For complete details and wiring diagrams, ask your wholesaler for Bulletin 231, or send the coupon in.



send coupon today!

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Gentlemen: Please send me Bulletin 231 on the new Murray PJ series of distribution panels.

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COMPANY_____

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The only fittings of their kind...

APPLETON

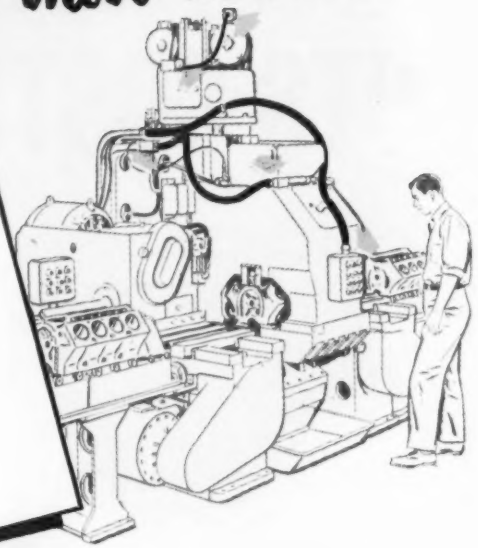
"ST" Series CONNECTORS*

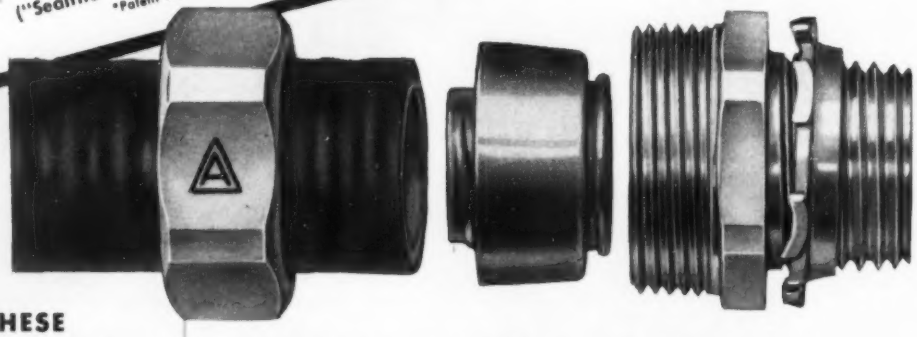
for

Liquid Tight Flexible Conduit

("Sealtite" or Equivalent Products)

*Patent Applied For

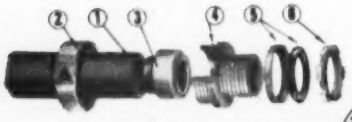




NOTE THESE EXCLUSIVE FEATURES

- Positive ground between flexible conduit and connector.
- Less than 10 millivolts voltage drop.
- Will not vibrate loose.

QUICK and SIMPLE TO INSTALL



Meet UL and JIC Standards

Cut conduit (1) to desired length. Pass nut (2) over conduit. Screw ferrule and sleeve assembly (3) into conduit. Insert ferrule assembly in connector body (4) Tighten down the nut (2) as far as possible, thus collapsing sleeve wall and forming a liquid-tight seal. (When liquid-tight connection is required for knockout of steel junction box, a gasket assembly (5) and locknut (6) are used.)

QUICK, EASY to INSTALL... Complete from ONE Source

■ On any machinery wiring job, contract or time and material, you'll do better with *Appleton* "ST" Series Liquid Tight Connectors.

First, they provide the protection the job requires. *Second,* they are engineered for quick, easy installation . . . even an apprentice can complete a job that will pass inspection! *Third,* ALL parts are supplied from *one* source . . . your wholesaler carries a complete stock.

Appleton "ST" Series Connectors come straight, 45° and 90° to fit flexible conduit sizes from ⅜" to 1¼". Also 1½" and 2" straight.

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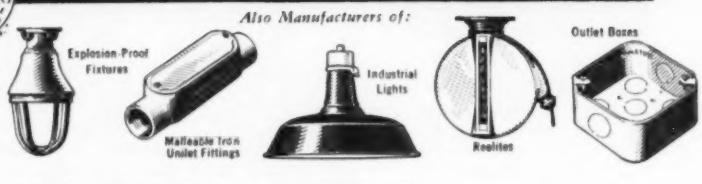
APPLETON ELECTRIC COMPANY

1704 Wellington Avenue • Chicago 13, Illinois

Also Manufacturers of:



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with which is consolidated Electrical Contracting, The Electragist and Electrical Record — Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

53rd Year **NOVEMBER • 1953**

Washington Report 61

At a Glance 63

No Place to Hide 65

Mobile Emergency Floodlighting 67
An electrical contractor's emergency floodlighting service gave G-M a head start on machine and tool removal at its burned-out Livonia plant.

Uprating Horsepower With Silicone Insulation 70
By G. E. McINTYRE and E. P. EARLEYWINE—Silicone electrical insulation is used to "uprate" standard size motors to greater power output.

Propeller Production Backed by Flexible Distribution 71
By H. P. SCOTT—Dual electrical feeder systems, flexible bus-duct networks, multi-voltage power are features of this research center.

Electronics for Defense 77
General Electric's new research and production center is another in the series of outstanding electrical construction jobs.

Electrical Installations in the Petro-Chemical Industry 86
By B. Z. SEGALL—A discussion of National Electrical Code requirements for Class I hazardous locations.

Business Outlook 91
By DEXTER M. KEEZER—A report on current business trends.

Contractor Ingenuity Speeds Header Duct Installation 92
Motor City Electric Co. develops hydraulic grommeting tool to tie duct to cellular steel sub-floor panels.

Mobile Color Lighting 96
By R. G. WILLIAMS—Principles of color blending, fundamentals of application for dramatic color effects, color lighting systems, and methods for control.

Common Code Problems 102
By B. A. McDONALD—Selected code questions of wide industry interest discussed in detail.

MORE

NOVEMBER • 1953 *continued*

How Construction Techniques Affect Estimating 105
By J. P. REYNOLDS—New building construction materials and techniques may require special methods of electrical installation before an estimate can be prepared.

Industrial Power Distribution—Part II 106
A review of modern trends and practices in industrial power distribution.

Practical Methods 175
Adjustable drilling frame uses hydraulic pressure; care and protection of truck batteries.

Motor Shops 183
Bench holder for armatures; visual stock parts facilitate order ng; causes and cures for overheated bearings.

Reader Service 191
Product news announcements; catalogs and bulletins.

Reader Quiz 219
Questions and answers on Repulsion induction motors; protective devices; bearings on motors; siren tone.

Questions on the Code 229
Answers to code questions including size of service board neutral; transformer vault; flexible cord; switching inductive loads.

Modern Lighting 237
Canopy provides accent for showroom display; floodlights for auto sales and parking; even distribution for office machines.

Data Sheet 245
Practical hints for installing rigid conduit.

In the News 248

Dates Ahead 267

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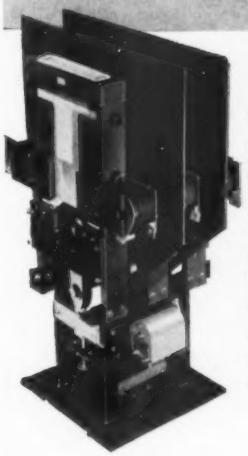
which contactor meets your needs

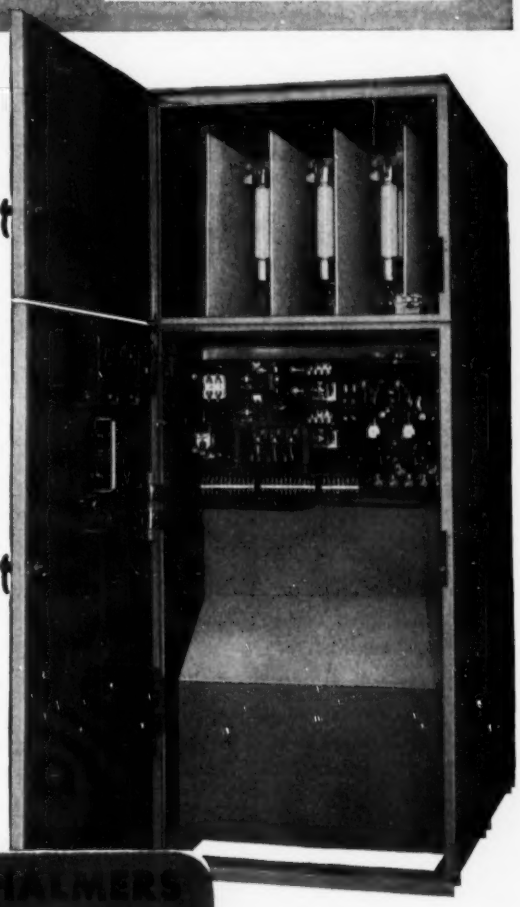
AIR or OIL?

Either may be built into your Allis-Chalmers Type H starter along with meters, overload relays, current limiting fuses, auxiliary switches . . . the coordinated components dictated by your application for complete protection of man, motor and machine.



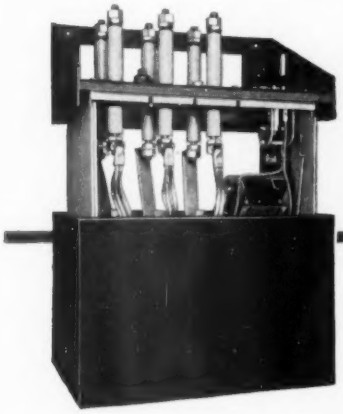
AIR-BREAK CONTACTOR

When the going's rough . . . that's the place for the Type 256 air-break contactor. Frequent starting, inching, reversing or dynamic braking are taken in stride by this rugged performer. And, of course, fire hazard is greatly reduced. No turning shafts, shaft bearings and flexible leads to cause maintenance headaches. Double-break contacts, vertical action and dual blowouts provide long, trouble-free operation.



OIL-IMMERSED CONTACTOR

Got atmospheric troubles? The Type MO oil-immersed contactor will perform heavy duty starting service in dust-laden, corrosive and very moist atmospheres. Contactor is of the time-proved clapper type. Self-cleaning, rolling-wiping action extends contact life. Make and break arcing occurs only on tips. Self-aligning E type magnet provides perfect armature seating . . . long, quiet operation. Permanent windlass tank-lifter simplifies maintenance. A-4103



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Type H Starters

FOR 1300 TO 3000 VOLT MOTORS

Call Your Nearby A-C Representative or Write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 14B6410B.

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New MAGIC "E" saves space . . . saves time . . . saves money

MORE THAN 15 MILLION STAB-LOKS have been installed in three short years. And now Federal Noark's Magic "E" slots in Stab-lok bus bars *multiply* your opportunities to install Stab-lok and save space, time and money, as well!

The Magic "E" slots and sequenced bussing that are standard in many Stab-lok enclosures are designed to accommodate:

(a)—Single and double pole (simultaneous trip) Stab-loks Type NA;

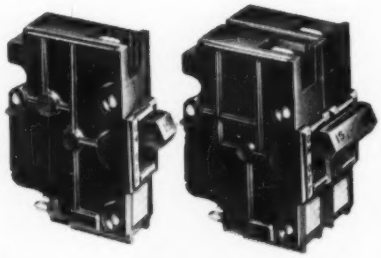
(b)—The new space-saving Stab-lok breakers, Type NC. These new breakers come in 15 and 20 amp. capacities. They are half as wide as the Type NA . . . two NCs can be inserted in place of one NA.

The flexibility and widespread combinations of individual pole breakers thus made possible are simply amazing. In addition, smaller enclosures can be installed with ample capacity for future circuit expansion.

Order Federal Noark Stab-lok from your distributor. And write for the new Magic "E" booklet that gives you the whole story of Stab-lok's tremendous improvement.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

STAB-LOK CIRCUIT BREAKERS TYPE NC. One-half inch wide . . . two can be inserted in place of one Type NA. Made in 15 and 20 amp. capacities.



STAB-LOK CIRCUIT BREAKERS TYPE NA. The original Stab-lok. Single and double pole (simultaneous trip). Made in standard range of 15 to 50 amps.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

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STRAIGHT CONNECTORS

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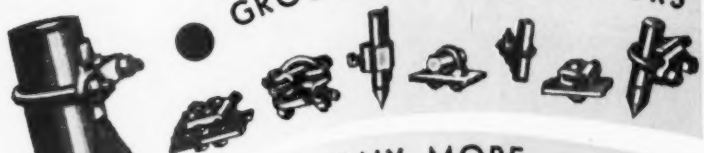

and MANY MORE

PENN-UNION Catalog

The conductor fittings shown here can only suggest the wide variety. You'll find practically every good type, in a complete range of sizes.

New connectors are constantly being added - - so when you need a special fitting for an unusual service, tell us about it. Most likely we have exactly what you want.

Better design is a Penn-Union feature that you'll appreciate. For example, note the large gripping surfaces for wrenches, on the service connector shown in the upper left corner. When you use any Penn-Union fitting, you are sure that it is dependable - - mechanically and electrically.

Preferred by Leading Users, who have found that the "Penn-Union" mark on a connector is their best guarantee of unfailing service.

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THE *Complete* LINE OF CONDUCTOR FITTINGS

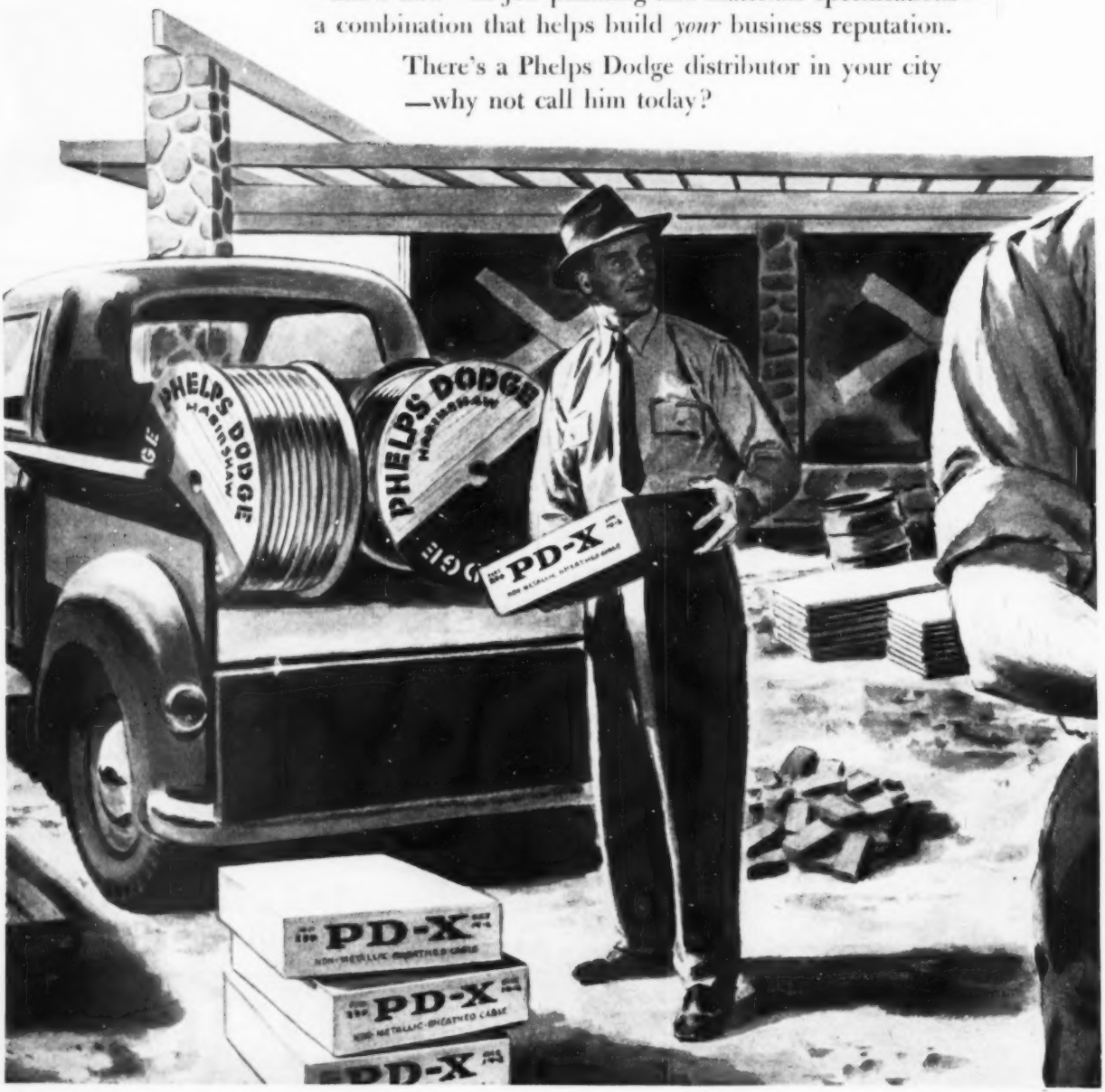
PENN-UNION

Quality and Service

When you call your Phelps Dodge distributor, you can be sure of getting the kind of help that speeds job completion . . . gives you full job profit.

He offers you two important aids: the highest quality materials and a wide background of experienced "know-how" in job planning and materials specifications—a combination that helps build *your* business reputation.

There's a Phelps Dodge distributor in your city —why not call him today?



are as near as your Phelps Dodge distributor's telephone!

PHELPS DODGE COPPER PRODUCTS CORPORATION

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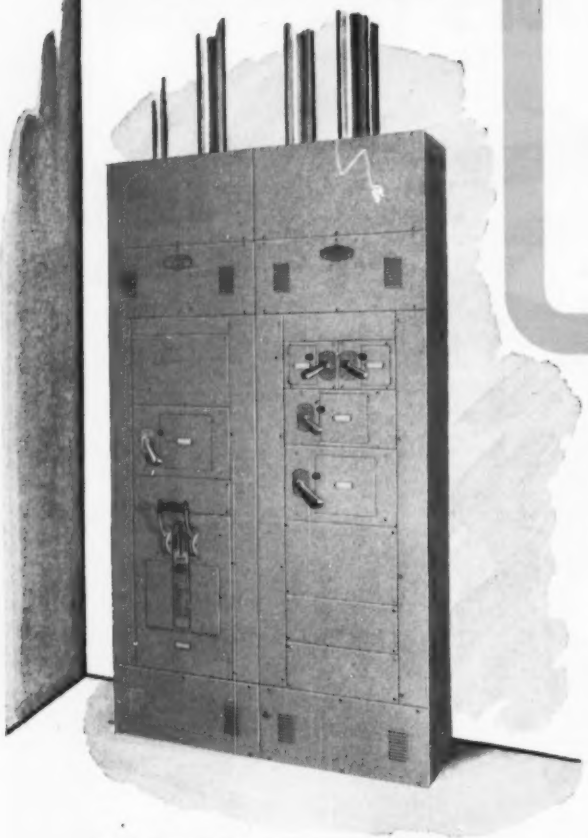
where space is limited

INSTALL FA SWITCHBOARDS front-connected



The FA Switchboard, Front-Connected illustrated here is 54" x 96" x 14½" and contains two (2) 60 Amp., one (1) 100 Amp., two (2) 200 Amp., and one (1) 400 Amp. 3 P. Shutlbrak Switches; also space for two (2) 100 Amp. and two (2) 200 Amp. future switches.

FA Switchboards, Front-Connected are available in the following types and capacities:

SHUTLBRAK — 30 to 1200 amperes, 250 volts AC or DC and 600 volts AC. Rotary type operating handles furnished on 30 to 200 ampere capacities. Straight handles on all others.

KLAMPSWITCHFUZ — 30 to 600 amperes, 250 volts AC or DC.

SNUFARC — 30 to 200 amperes. 600 volts AC.

Like all FA Switchboards, these space-saving boards are built from standard, pre-assembled units that fit readily together to form one complete assembly.

Designed for floor mounting against wall, they are constructed of standardized unit type sectional enclosures with integral pull boxes at top and bottom.

Switching units are either Shutlbrak or Klampswitchfuz, plug-in design, permitting ready interchangeability and replacement without the use of tools.

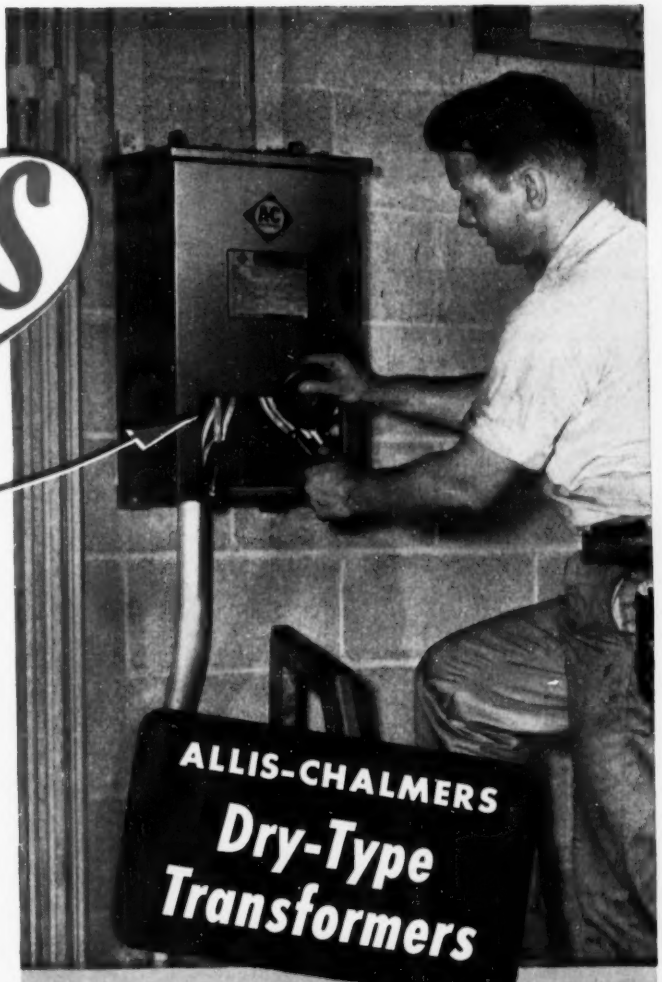
Want to know more about these light and power distribution units? Your nearest FA representative, listed in Sweets, will be glad to give you complete information.

Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

EASY ACCESS



Saves Installation Time!

You get plenty of room for making connections on Allis-Chalmers dry-type transformers. As the photo above shows, a removable plate at the front bottom of the case makes it easy to pull wires out and make connections. This feature is available on single-phase units 10 kva and below and three-phase units 15 kva and below.

For the higher ratings, you can remove the top cover to get equally easy access to connections. In addition, solderless clamp-type connectors are available on single-phase sizes 15 to 50 kva inclusive, three-phase sizes 45 to 112½ kva inclusive.

Compact design helps simplify installation too. Allis-Chalmers dry-type transformers are light weight. They take little space. You can mount them anywhere — on walls, beams, or right on the machine they serve. Their all-welded cases give complete protection. No need for vaults or enclosures.

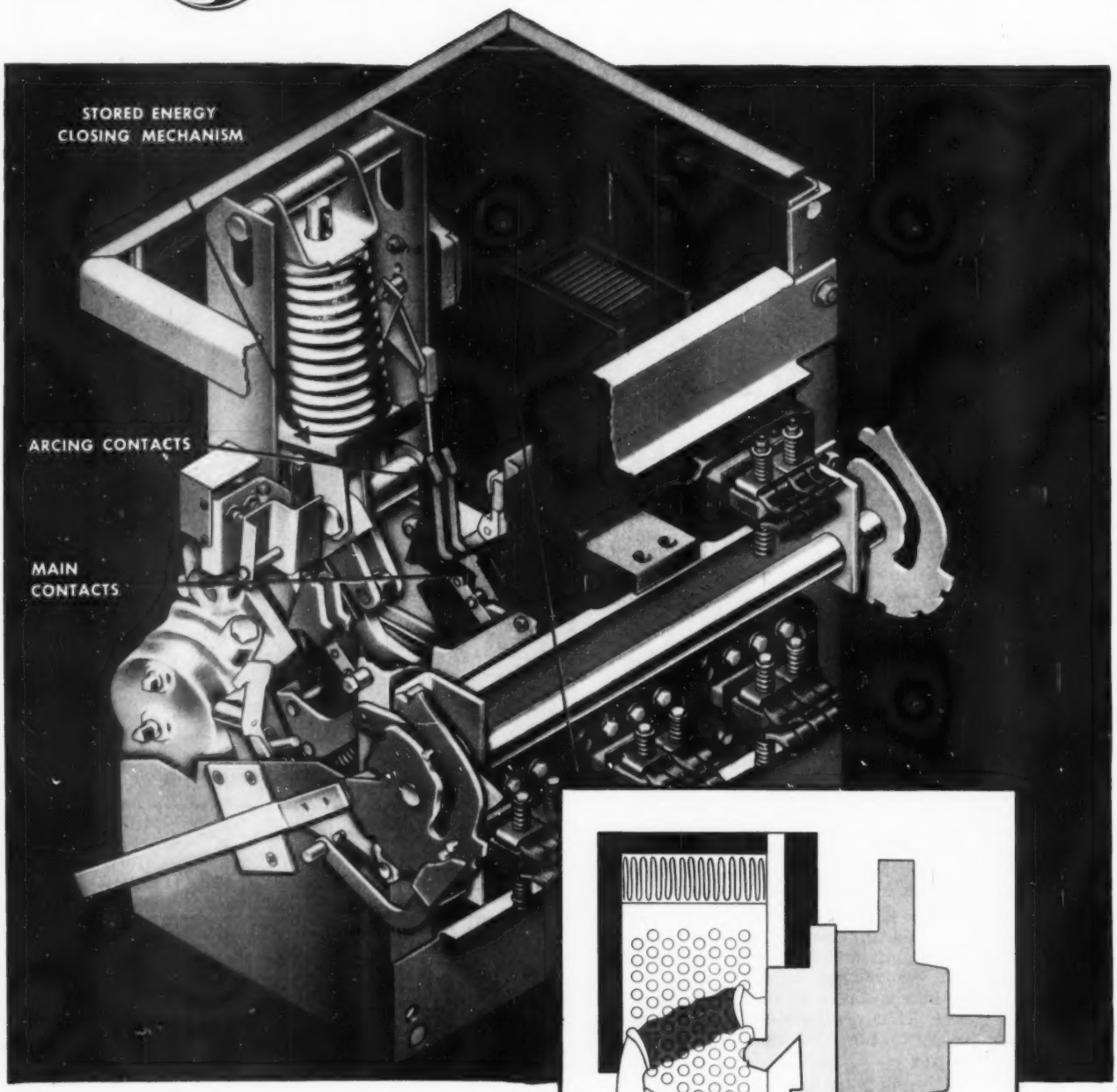
Get all the facts by calling your nearby Allis-Chalmers district office or authorized distributor. Or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4188

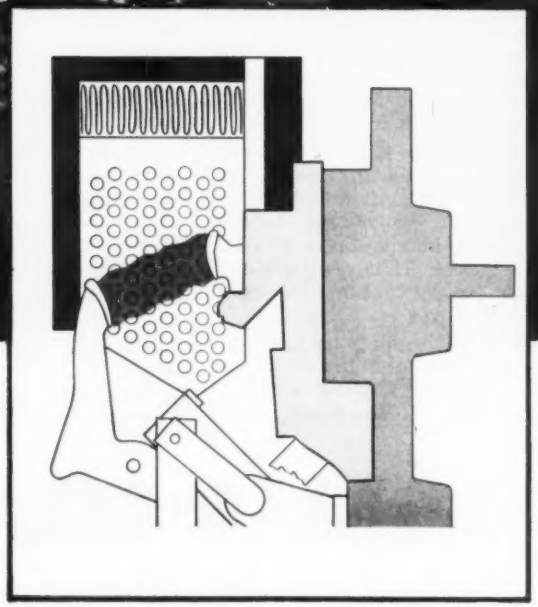
DESIGN ARRANGEMENTS

KVA SIZES		MOUNTING ARRANGEMENT	TERMINATIONS
SINGLE PHASE	THREE PHASE		
3 5 10	9 15	WALL MOUNTING LUGS	BOTTOM TERMINAL COMPARTMENT WITH REMOVABLE FRONT PLATE
15 25	30	WALL MOUNTING LUGS AND BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER
37½ 50 75 100 167	45 75 112½ 150 225 300	BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER

ALLIS-CHALMERS

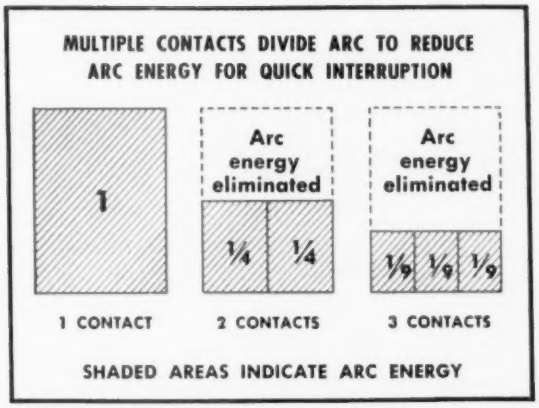
New air circuit breaker



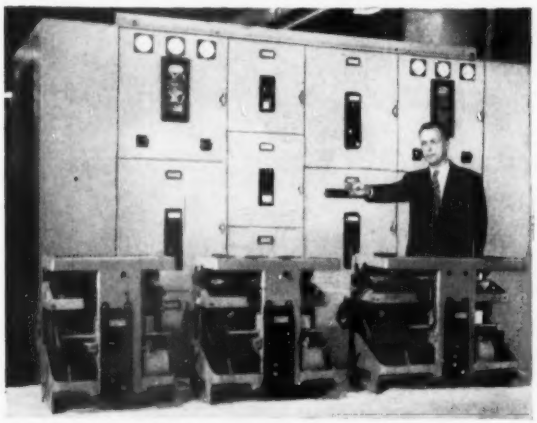


MULTI-SLOT INTERRUPTER, in diagram at right, is exclusive feature on new air circuit breaker. When interrupting a short-circuit, perforated barriers of phospho-asbestos compound form slots for parallel arc paths with faster arc extinction. Silver tungsten arcing contacts provide high-resistance to burning. Spring-loaded stationary main contacts are placed inside current loop, eliminating motion of contacts due to magnetic forces.

uses *multi-slot* interrupters with exclusive design



BECAUSE ARC ENERGY is proportional to the square of the current ($E = kI^2$) dividing the arc into multiple paths greatly reduces the arc energy and the contact burning. If a single contact per pole is replaced by 2 parallel contacts per pole, the total arc energy is reduced to ½ per pole—or to ¼ for each contact. For 3 parallel contacts per pole, the total arc energy is reduced to ⅓ per pole.



G.E.'S THREE NEW BREAKERS—Dimensions of AK-1-50, AK-1-75 and AK-1-100 air circuit breakers, left to right, vary only in width. Units complete AK line with ratings from 15,000 to 100,000 amps. Breaker design is completely coordinated with new drawout equipments.

Outstanding benefits are

. . . less burning of arcing contacts—due to reduced arc energy.

. . . short-time ability equal to interrupting ability.

. . . no damage to main contacts.

The new multi-slot interrupter design—a G-E first—along with an exclusive contact linkage, has been used on the new AK-1-50, -75 and -100 breakers with interrupting ratings of 50,000 . . . 75,000 . . . and 100,000 amperes.

Perforated barriers between multiple arcing contacts of the interrupter assure faster arc extinction and minimum contact deterioration. The entire assembly can be removed for maintenance.

New arrangements of multiple main contacts make the interrupter an important factor in assuring 30-cycle short-time ratings which are equal to full interrupting ratings for the new AK breaker. The linkage uses short-circuit forces to help hold contacts closed.

The small multi-slot unit makes possible a more compact breaker and consequently, the new drawout equipment is smaller in size.

Outstanding design features of the new AK breakers are high-lighted by G-E exclusives—

Stored-energy closing mechanism—for safe, sure closing even though control power is lost during closing operation—a G-E exclusive.

Selective operation—up to full interrupting rating—another G-E exclusive.

Interchangeable parts—on new breakers cut down your parts stocking problem and simplify maintenance.

Racking mechanism—is part of breaker and permits inspection outside compartment away from live parts.

New equipments—designed and tested to withstand up to 100,000 amps. Design improvements give you many new features and benefits.

New breaker-handling device—is designed as integral part of units. Optional for both indoor and outdoor equipments.

For details on the new AK breaker—and new low-voltage drawout switchgear equipments—ask your G-E sales representative for Bulletin GEA-5916, or write to General Electric Company, Schenectady 5, N. Y. 873-4

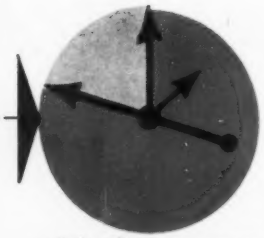
You can put your confidence in—

GENERAL ELECTRIC

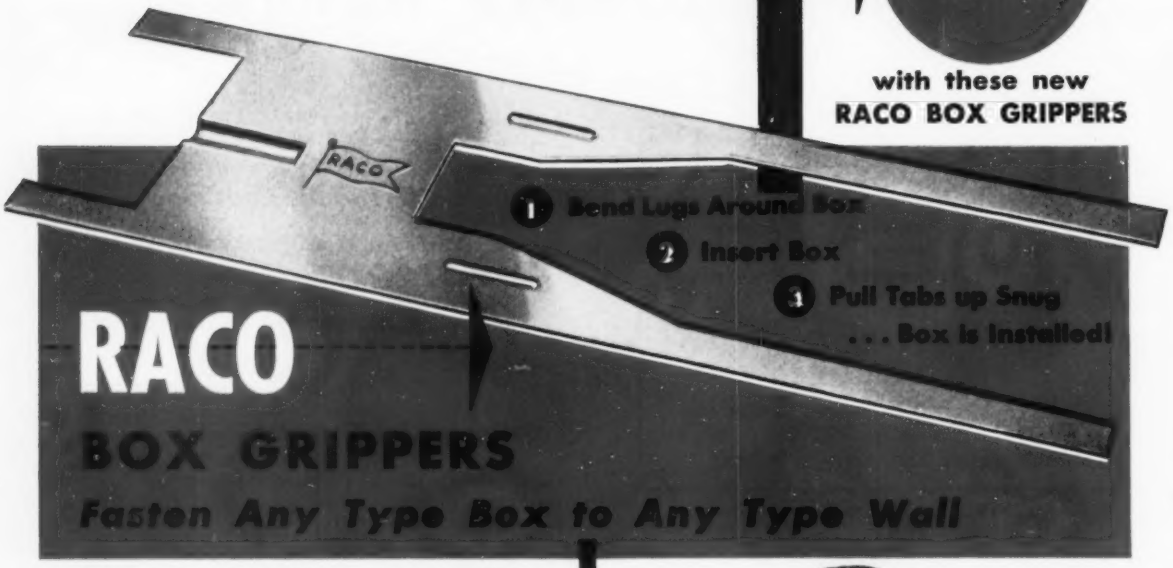
You can always rely on RACO

Save Time! Save Money!

INSTALL A RACO BOX IN 47 SECONDS

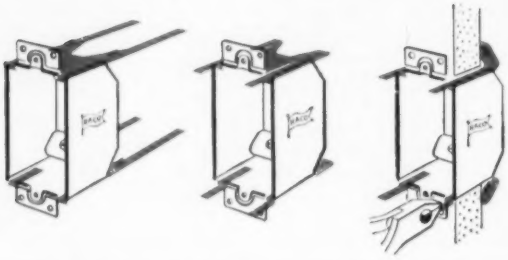


with these new
RACO BOX GRIPPERS



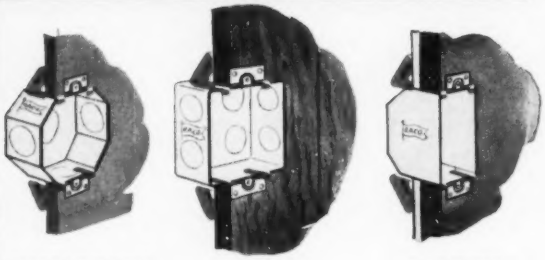
RACO
BOX GRIPPERS
Fasten Any Type Box to Any Type Wall

HERE IS HOW IT WORKS

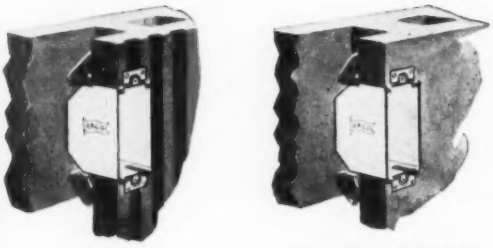


YOUR MEN WILL LIKE RACO BOX GRIPPERS

Raco Grippers are so easy to use! Just lay gripper on box . . . bend lugs over end of box and bend tabs forward. Insert box. Pull tabs up snug. Box is solidly and permanently fastened to any type of wall! Use Raco Box Grippers on any single or multiple wall box.



WALLBOARD WOOD PLASTER



TILE CONCRETE BLOCK

WRITE TODAY—Get Complete Information on RACO Box Grippers

"A BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. • Aurora, Illinois

BLACKBURN
Hi-Strength
TERMINAL LUGS

YOUR BEST BUY-
5 REASONS WHY!

LISTED UNDER REEXAMINATION SERVICE UL OF UNDERWRITERS' LABORATORIES, INC.

1. A high-strength, superior-quality Lug in the lowest price range.
2. Made all in one piece — no joined parts to break loose.
3. Small and compact — will fit in small gutters and other very close quarters.
4. 6 sizes as illustrated cover a complete wire range from No. 14 to 1,000,000 CM.
5. Only 3 socket wrenches cover 4 sizes, and a screw driver tightens the 2 smaller lugs. Also available with hex head bolt instead of socket set screws.

Jasper Blackburn Corporation

35 MADISON ST. • ST. LOUIS 6, MO.

Phone CEntral 3007

Mail Coupon for Sample and Full Details

Send me sample and further information on BLACKBURN HI-Strength Terminal Lugs:

Wire Size _____

Your Name _____

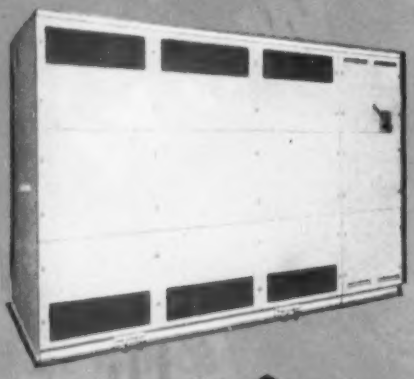
Company _____

City & State _____ ECM

Mail to Jasper Blackburn Corporation • 35 Madison St. • St. Louis 6, Mo.

To Achieve the Ultimate Savings Possible in Your Power Distribution System . . .

Specify MOLONEY TRANSFORMERS



Typical Indoor Dry-Type Load Center Transformer (2400 Volts and Above)

Typical Dry-Type, Air-Cooled Transformer (600 Volts and Below)

Typical large Distribution Transformer Available in Standard Ratings of 167, 250, 333 and 500 Kva.

Higher distribution voltages give greater operating efficiency to electrical equipment through greatly improved voltage regulation. Industrial power rates are appreciably lower at higher distribution voltages.

Today's trend is toward consumers installing their own transformers to realize these sizeable savings and to achieve this improved voltage regulation.

Your local utility can advise you concerning the distribution voltage best suited to your needs.

In order to achieve the ultimate savings possible, specify Moloney Transformers. You will find, as many utilities already know, that Moloney Transformers afford the following features of prime importance:

1. **Efficient Operation**
2. **Location Flexibility**
3. **Low Maintenance Cost**
4. **Quiet Operation**

ME53-19

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = BETTER PERFORMANCE, GREATER RELIABILITY, LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

NEW

You need it! Send for free copy today!

United States Rubber Company, the only electrical wire and cable producer to grow its own natural rubber and to manufacture its own plastics and synthetic rubber, makes a complete line of electrical wires and cables for every industrial and domestic application. Just published is the 1953 "U.S." Catalog, essential for men who specify, install or maintain electrical wire and cable. Send for your free copy to address below. Here are the catalog chapter headings:

1. U.S. Royal Portable Cords and Cables
2. U.S. Railroad Wires and Cables
3. U.S. Power Cables
4. U.S. Control and Signal Cables
5. U.S. Building Wires and Cables
6. U.S. Bare and Weatherproof Wires
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"U.S." Research perfects it...

"U.S." Production builds it

U.S. RUBBER
SERVING THROUGH SCIENCE

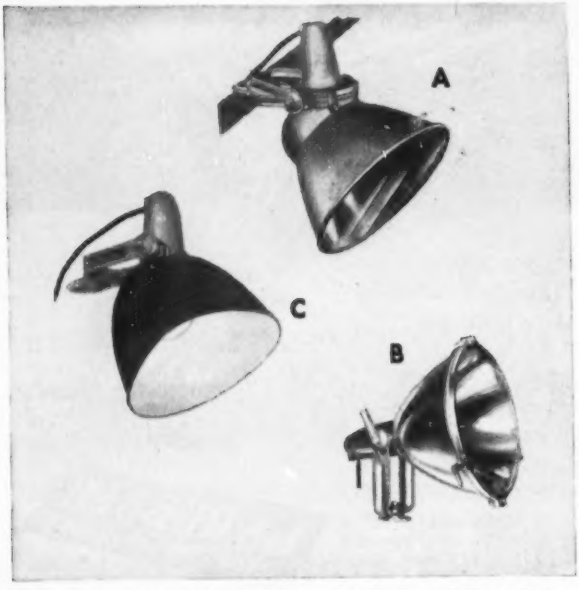
UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT · Rockefeller Center, New York 20, N.Y.

STANDARD PLANS for all ordinary sports make it easy for you to bid on floodlighting projects. They can also be provided for industrial floodlighting jobs. Engineering diagrams, lists of equipment and accessories are furnished for your convenience. Write for Bulletin GET-1284, Manual of Floodlighting Plans.

YOU SAVE TIME because of the design of G-E floodlights. On the G-E L-69, a simple beam sight permits easy aiming during the daytime. No tools are necessary for initial positioning, routine maintenance adjustments, or relamping. This will save you dollars in man hours required for the floodlighting job.

G-E Floodlighting Can Mean Profits For You



ANY LIGHT THAT YOU NEED is available from G.E.'s full line, for example: **A** High efficiency, lightweight, easy-to-install area floodlights for crossarm mounting with a choice of three-beam spreads; **B** Heavy-duty, wide variety of mountings and beam spreads; **C** Inexpensive, open floodlight for low-cost illumination.

Engineered Floodlighting Plans Simplify Bidding, Installation

Floodlighting installations offer profit opportunities to you. Sports lighting, factories, storage areas, parking lots, and building illumination are but a few of the many locations where floodlighting is needed. After the initial installation, floodlight maintenance contracts offer attractive profits too.

General Electric offers you floodlights and equipment that are carefully engineered to fit all types of applications.

This means savings as the lights are designed for fast, easy installation and long life. G.E. also maintains a staff of trained lighting specialists in many of the major cities to assist you with your lighting problems. For more information, contact your local G-E Distributor, or write for Bulletin GEA-5378. Address Section 451-185, General Electric Company, Schenectady 5, N. Y.

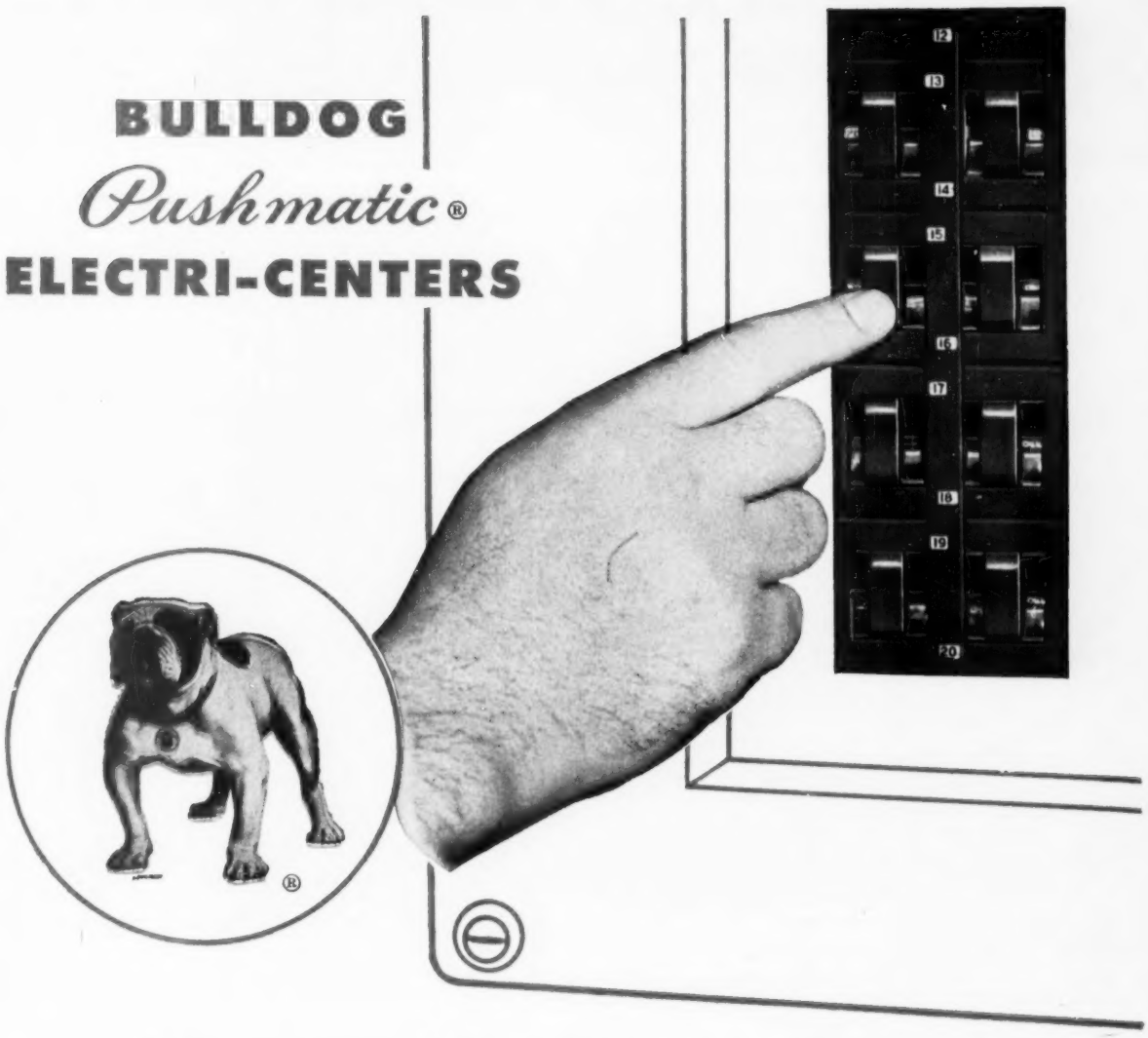
You can put your confidence in—

GENERAL ELECTRIC

BULLDOG

Pushmatic®

ELECTRI-CENTERS



Thoroughbreds on Guard!

The clean, neat exterior of BullDog Pushmatic Electri-Centers is truly indicative of their thoroughbred quality and safe, dependable operation.

Only Pushmatics give you simple-to-operate push-button control. On guard over electrical equipment like a row of sentinels, Pushmatics let you easily see whether the circuit is on or off. When a short or overload occurs, the push-button snaps forward, automatically breaking the circuit, and word "OFF" appears. Once the trouble has been remedied, simply *push the button,* and service is instantly restored.

BullDog Pushmatic Electri-Centers are available in sizes from 2 to 42 circuits, to fill every industrial, commercial or home requirement. Write today for free Bulletin PM-355 giving complete information. BullDog Electric Products Company, Dept. EC113, Detroit 32, Michigan.

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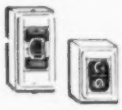
BULLDOG
ELECTRIC PRODUCTS COMPANY

GENERAL-PURPOSE CONTROL

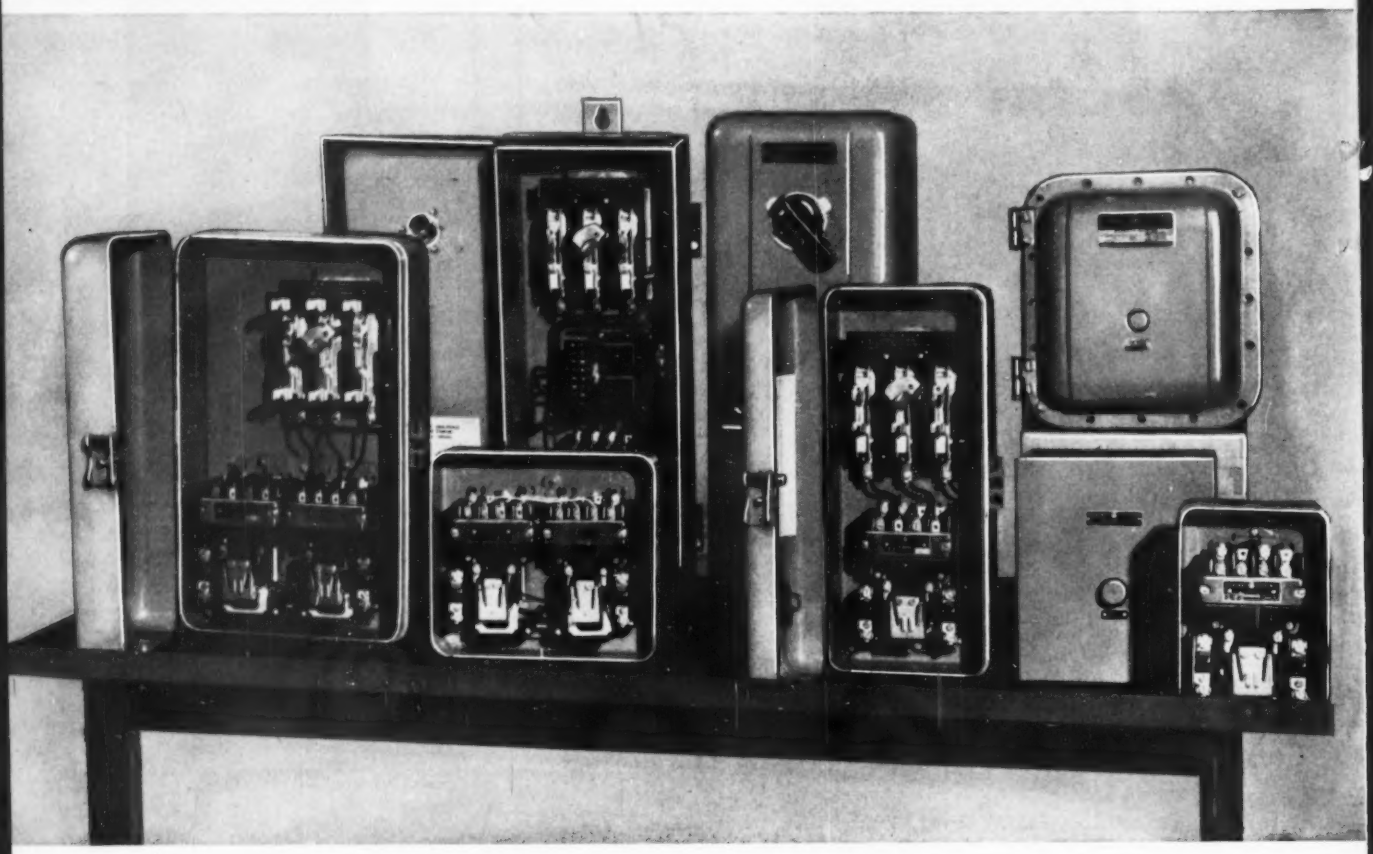
Fhp motor starter


1—7½ hp manual motor starters

A-c magnetic motor starter

Combination motor starter

Reversing motor starter



Meet Any Motor-Starting Application With A Dependable G-E Magnetic Starter

Thousands of Forms Available

No matter what your requirements, you can get a G-E starter to fit your application. Hundreds of variations of across-the-line, combination, reversing and multi-speed starters are available for a-c motors.

Every form pictured above has the same basic contactor that has proved its superiority again and again in severe industrial applications. You can choose from literally thousands of combinations of the contactor, shown at the right, and its accessory components, to get the best control for your particular motor application.

EXTRA INTERLOCK CONTACTS—as many as four on sizes 0 and 1, three on sizes 2 and 3—can be added to the standard starter for your application.

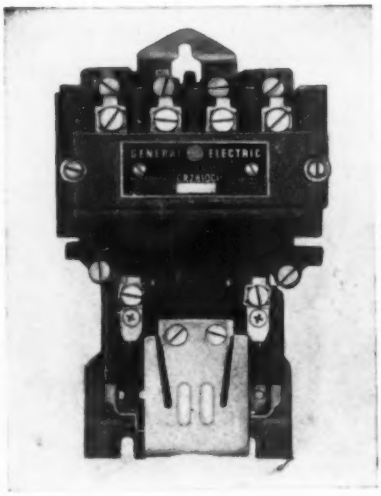
CONTROL TRANSFORMERS for operator protection, extra overload relay for motor protection, and control relays are available as standard components.

EITHER START-STOP push buttons or Hand-Off-Auto selector switches can be mounted in the starter cover.

ENCLOSURES for every motor application include general purpose, watertight, dusttight, semidust-tight, and explosion-proof. Enclosures that meet JIC specifications are also available.

ALL STARTERS have plenty of wiring space. Contacts, coils and overload relays can be removed quickly, conveniently.

Contact your nearest G-E apparatus sales office or authorized agent or distributor for your starters. Write for Bulletin GEC-880 for more details.



INFORMATION FOR CONTRACTORS-PLANT ELECTRICIANS

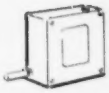
Reduced voltage starter

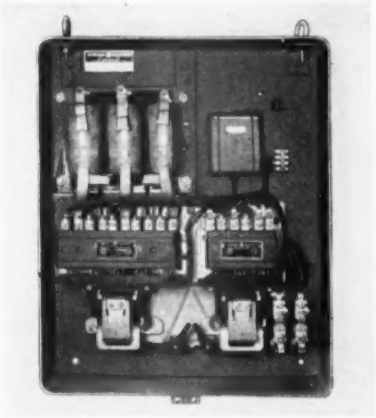
Heavy and standard-duty push-button stations

General-purpose relay

A-c and d-c solenoids

Roller-lever type limit switch

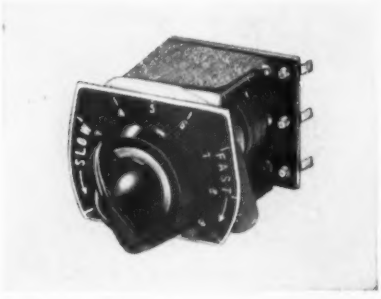

Rotating-type limit switch



G-E REDUCED-VOLTAGE MAGNETIC STARTER SOLVES POWER PROBLEMS

When load limitations prohibit motor starting at full voltage, this autotransformer-type starter controls and protects the operation of motor-driven pumps, conveyors, compressors, blowers, etc.

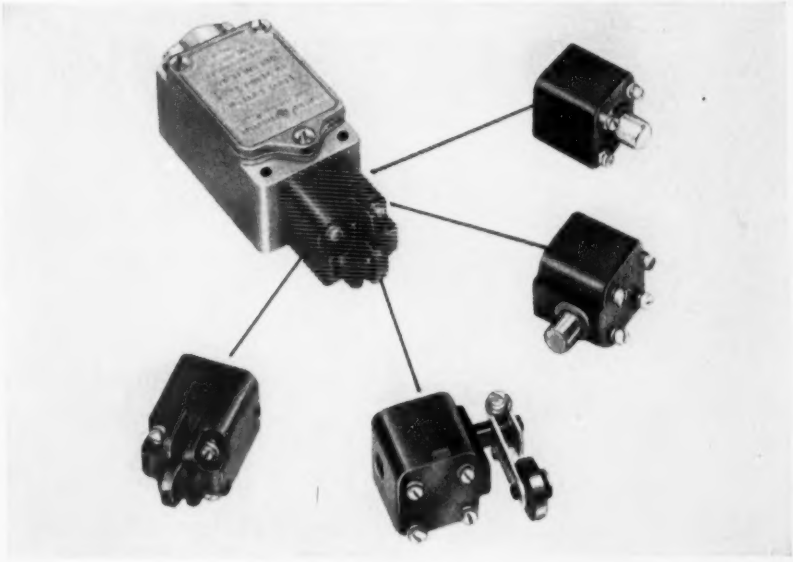
Available in air-break and oil-immersed designs, this hard-working starter for motors up to 250 hp utilizes the most modern materials and methods to give exactly the kind of operation you require for years to come.



NEW OILTIGHT POTENTIOMETER FOR CONTROL OF VARIABLE-SPEED MOTORS

This compact unit is part of the new G-E line of oiltight push buttons for use on a-c or d-c. It can be mounted in the standard G-E stations or enclosures or directly on the machine to be controlled. Ask for Bulletin GEA-5779 on the entire line of G-E oiltight push buttons.

SMALL G-E LIMIT SWITCH HAS FOUR INTERCHANGEABLE OPERATING HEADS FOR VARIETY OF APPLICATIONS



The basic contact unit—only slightly over two inches high—can be obtained with one of four different types of heads: roller lever, side pushrod, top pushrod, and roller pushrod. Case is oiltight—a gasketed cover keeps dirt and lubricating oils away from the contacts.

Little movement is required to operate it—18 degrees with a one-inch radius arm, 5/64 inch for the plunger type. Use this switch on machine tools, battery truck lift platforms, on small machines as a pilot device, and as a safety interlock on enclosing cases. Operates on a-c or d-c. Double-throw snap-action contact is easily accessible for wiring, and there is adequate room within the cast aluminum case for connecting to terminals, which are extra large. Bulletin GEA-5707.

NEW DUST-TIGHT/LINT-TIGHT G-E MANUAL MOTOR STARTER

For Motors Up to 7½ Hp

Listed by Underwriters' Laboratories and Factory Mutual, this starter for motors up to 7½ horsepower is completely dust tight. Special gaskets and cover fastenings keep dust from contacts—reduce the fire hazard. Two- three- and four-pole forms have bi-metallic overload relays with front-connected heaters. Switch lever moves to neutral position on overload, is vibration resistant.

Switch interior can be reversed in the enclosure for either top or bottom feed, and ON-OFF nameplate can be easily reversed.

For more information contact your nearest G-E representative, agent, or distributor, or write Section A 730-45, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

work-inspiring lighting created by

GUTH* GRATELITE CEILINGS

* U. S. & Can. Pats. Pend. Trademark Registered

Guth

Work is a pleasure with this velvetized light . . . diffused by beautiful, lattice-like GRATELITE, installed in the offices of MacKenzie, Knuth & Klein, Architects of Flint, Michigan.

data:

Room Size: 23′4″ x 9′10″ x 10′9″

Luminaires: Guth Super-Strips
12 96″ T-12 Lamps, 4500° White
Mounted on 24″ Centers, 10′6″ high

GRATELITE **Ceiling:** Mounted 8′6″ above floor

Foot-Candles: All Super-Strips on—86 F. C.
One-Half Super-Strips on—42 F. C.

	BRIGHTNESS READINGS:	FOOT LAMBERTS	C.P./SQ. IN.
1.	*GRATELITE Ceiling at approx. 30° Angle*	120	.260
2.	*East Wall (French Gray)*	20	.046
	Dado	13	.028
3.	*South Wall (Deep Coral)*	9½	.021
4.	*Floor (Natural Cork Tile)*	17½	.038
5.	*Desk (Chartreuse)*	36	.080

Just think: 86 Foot-Candles—and yet only 120 Foot Lambert Brightness! Never before was such low brightness with such high illumination values thought possible. Make this dream come true for you. Write on your letterhead for Catalog 905-A and GrateLite layout guide.

THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MO.

Leaders in Lighting Since 1902

30% GREATER CONTACT TRAVEL

With NEW KEYSTONE LMI PONY SIZE COLLECTORS

New advantages . . . new economies . . . are now offered with the Keystone LMI Pony Size Collectors! These new collectors are designed for continuous, efficient performance despite severe operating conditions. Outstanding advantages include: improved contact shoe, readily reversible, provides 30% greater contact travel, adds 300% more wearing thickness on each side, lower in overall height.

Solderless throughout, shunt connectors have non-loosening electrical connections. Copper plating on machined surface insures better electrical contact where shunt is connected and prevents corrosion. Maintenance simplified. Only one tool required.

The new Keystone LMI Pony Size Collectors last longer . . . help you reduce inventories and give improved service. For complete information ask for Bulletin 681B. Write today.

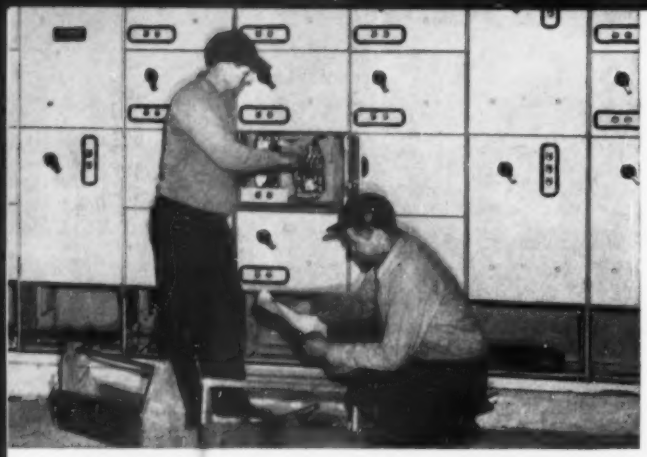
OUTSTANDING FEATURES

- 30% greater contact travel
- Improved contact shoe
- Efficient current transfer
- Solderless shunt connectors
- Rapid contact reversal
- Compensating terminal
- Lower overall height
- Collector reversible
- Easy to maintain

ELECTRIC SERVICE MANUFACTURING CO.

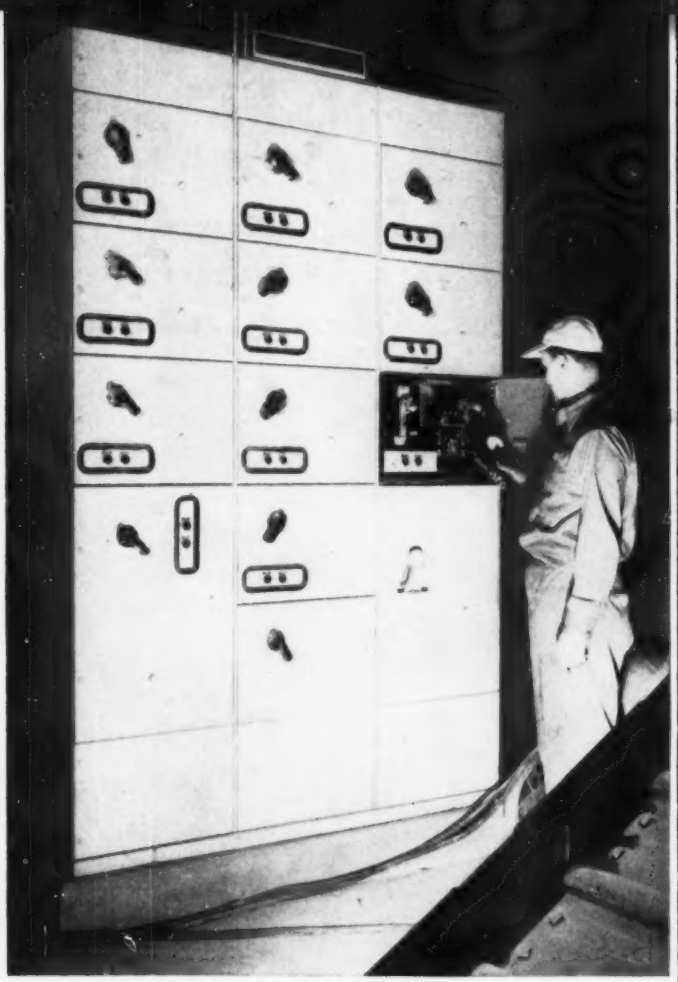
PHILADELPHIA 32, PENNA.

MANUFACTURERS OF COMPLETE LINE OF INSULATOR SUPPORTS FOR RAIL AND WIRE CONDUCTORS AND CURRENT COLLECTION DEVICES.



EASY-TO-INSTALL front-connected units and a large, accessible 13-inch conduit space make wiring fast. Lightweight, compact, strong units with stab-on connectors make handling easy.

A G-E PACKAGED JOB and proven dependability of G-E motor control centers sold the planning team of George Sall Metals Company and Kuljian Corporation engineers on specifying G.E.



STEEL BARRIERS isolate live busses from personnel for maximum safety during inspection and maintenance. Disconnect position allows safer maintenance without shutting down the center.

G-E Motor Control Centers Specified For New "Automatic" Processing Plant

The Kuljian Corporation, Philadelphia, engineers and constructors, specified G-E motor control centers to help in the "automatic" processing of scrap metal at the non-ferrous smelting plant of The George Sall Metals Company in Philadelphia. Like other industries—chemical, paper, automotive—where automatic control is important, George Sall Metals wanted the most modern up-to-date equipment available. They had the plant planned for the ultimate in economical and automatic processing.

Whether you are building a new plant or modernizing existing facilities, specify G-E motor control centers for centralized control of a-c motors up to 200 horsepower.

FOR MORE INFORMATION, contact your nearby General Electric Apparatus Sales Office or authorized distributor, or write Section 781-5 for Bulletin GEA-4979A today. General Electric Company, Schenectady 5, New York.

1878 75 1953
YEARS OF ELECTRICAL PROGRESS

You can put your confidence in—

GENERAL ELECTRIC

BATTLESHIP GREY

COLUMBIA

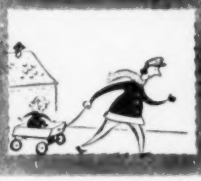
Flex

NON-METALLIC SHEATHED CABLE

TOUGHER

CLEANER TO HANDLE

SMOOTHER



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Electricians & Contractors are Insisting on this New and Improved Columbia Flex

Approved by Underwriters' Laboratories

COLUMBIA CABLE & ELECTRIC CORP.

Serving the Electrical Wholesaler Since 1912

255 Chestnut St. Brooklyn 8, N. Y.

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FLEXIBLE STEEL CONDUIT

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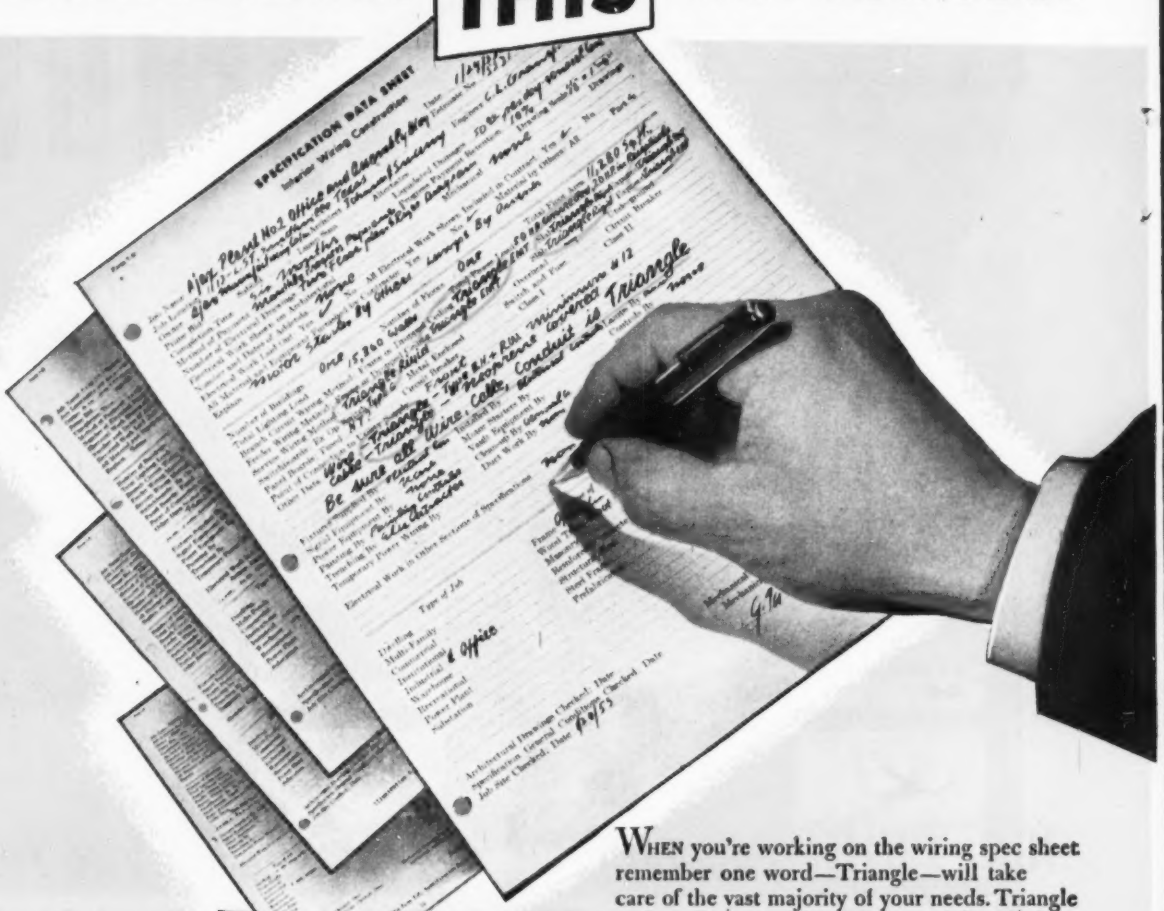
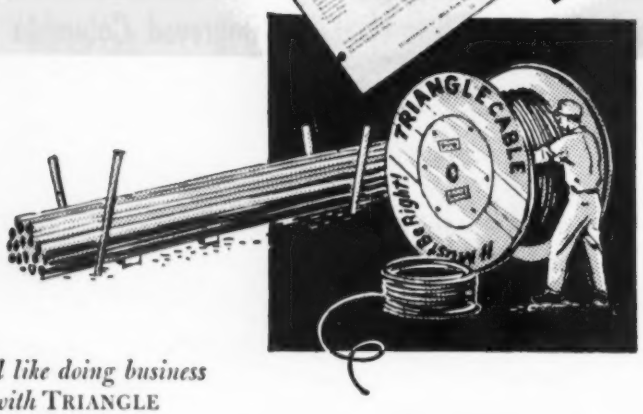
TRIANGLE'S Complete Line *plus* OVER 35 YEARS

OF EXPERIENCE MAKES THIS EASY FOR YOU!





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WHEN you're working on the wiring spec sheet remember one word—Triangle—will take care of the vast majority of your needs. Triangle makes all three of the most essential paths for electricity—wire, cable and conduit including: Feeder Cable, Branch Circuit Building Wire, Service Entrance and Drop Cable, Power Cable, Varnished Cambric Cable, Neoprene Jacketed Cable for direct burial or aerial use, EMT, Rigid Conduit, Armored Cable—you name it, *Triangle, through its nationwide network of top distributors,* can supply it.

Ask your distributor about the advantages of buying all your wire, cable and conduit from the same manufacturer. Deliveries are surer, there's less paper work and you have a feeling of confidence right down the line.

Hundreds and hundreds of America's most important contractors, power companies and industrials always specify high quality Triangle—across the board.

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IT PAYS TO BE RIGHT

TRIANGLE CONDUIT & CABLE CO., INC.

New Brunswick, N. J. • Moundsville, W. Va.

When it's a Question of Carrying Electrical Power—Specify **TRIANGLE**

Easier to Maintain!

EVERY PART REMOVABLE FROM FRONT *in* NEW CLARK *type* "CY" AC STARTERS

Besides featuring an entirely new principle of arc interruption which substantially lengthens contact life, CLARK Type "CY" AC MOTOR STARTERS provide faster and easier inspection and maintenance by a new design which permits removal of every part from the *front*. No special tools are required.

Figure 1 shows the clean-cut open construction with easy access to wiring terminals and all components.

1. To inspect movable contacts, simply push down contact bars to depress springs "I".
2. To inspect stationary contacts, open snap-action cover clips "B" releasing lower arc shield "C" (Figure 2).
3. To replace movable contacts, loosen captive screws "D" and remove contact arm. Contacts are now quickly removed by twisting in either direction. (Figure 3).
4. With contact arm removed, stationary contacts can be replaced by dropping lower arc shield and turning contacts with wrench.
5. Magnet coil is easily changed by removing coil connections and loosening captive screws in coil clamps "G". Now remove armature "F" by pushing snap-in pin "E" in direction of knurled head. (Figure 4).
6. Stationary Magnet Frame "H" can now be removed by taking out four screws holding it to base plate.
7. To insert or replace an overload heater coil, remove one screw "J" and lift off cover plate.
8. An entire overload relay assembly can be removed by disconnecting wiring and taking out two screws holding it to the base plate.
9. Control circuit relay block can easily be removed from the front by taking out one screw, after moving contact arm has been removed as in Figure 3.
10. Entire control unit—on base plate—can be lifted from cabinet by loosening three screws "A".

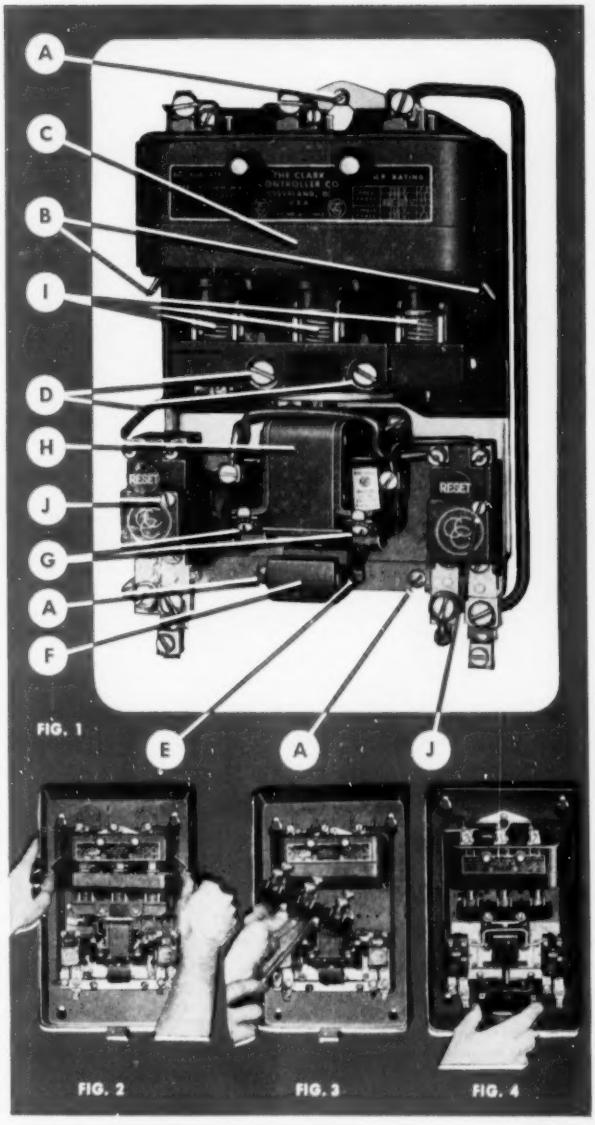

FIG. 1 FIG. 2 FIG. 3 FIG. 4

Could anything be simpler?

Complete accessibility from the front on CLARK Type "CY" AC Motor Starters makes a big hit with production and maintenance men. Available in sizes 0, 1, 2 and 3. Write for details.

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

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Type LB
Obround Condulet

Type FS Threaded,
With Pilot Lamp Receptacle,
Switch, and Plug Receptacle

Type EPC Explosion-Proof
Motor Starter and
Circuit Breaker
Condulet

Six-spindle automatic screw machine performs six operations simultaneously — makes dozens of hub reducers or conduit union parts every minute.

Crouse-Hinds modern methods produce a superior product . . . to serve you better

Crouse-Hinds factory is equipped with the finest modern machinery, designed for fast, accurate production. To turn out the quality work of which they are capable, such machines require expert handling. Crouse-Hinds machinists have the skill that can come only from long years of careful workmanship. A high percentage have more than twenty-five years of loyal service to their credit. These highly trained machine operators are producing a superior product . . . to serve you better.

More than 15,000 types and sizes of Condulets are listed in the Condulet Catalog . . . a type for every purpose in hazardous and non-hazardous locations.

Always specify Condulets and get the benefit of Crouse-Hinds quality on every job.

When quality counts . . . you can count on Condulets*

*CONDULETS are made only by CROUSE-HINDS

CONDULET
First in the field
STANDARD OF QUALITY

A Nationwide Distribution Through Electrical Distributors

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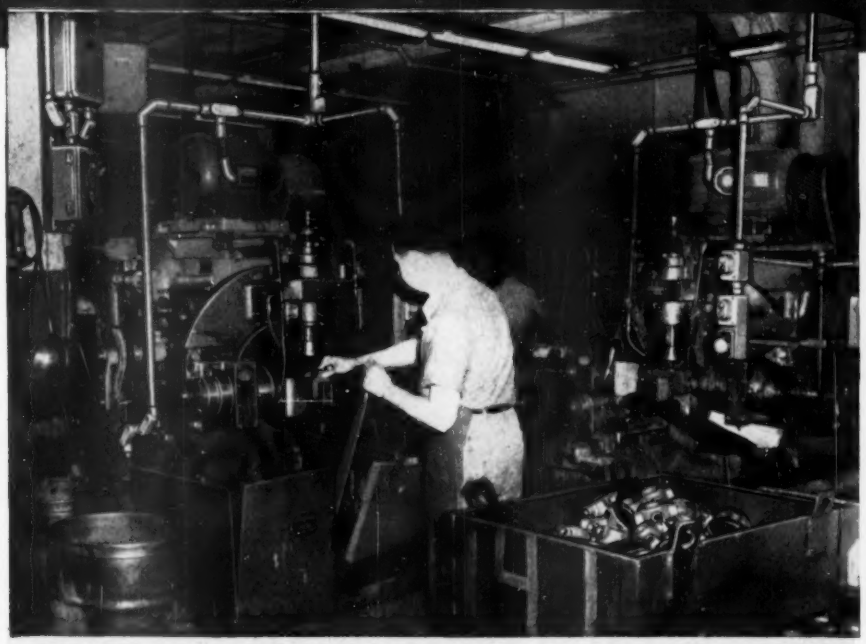
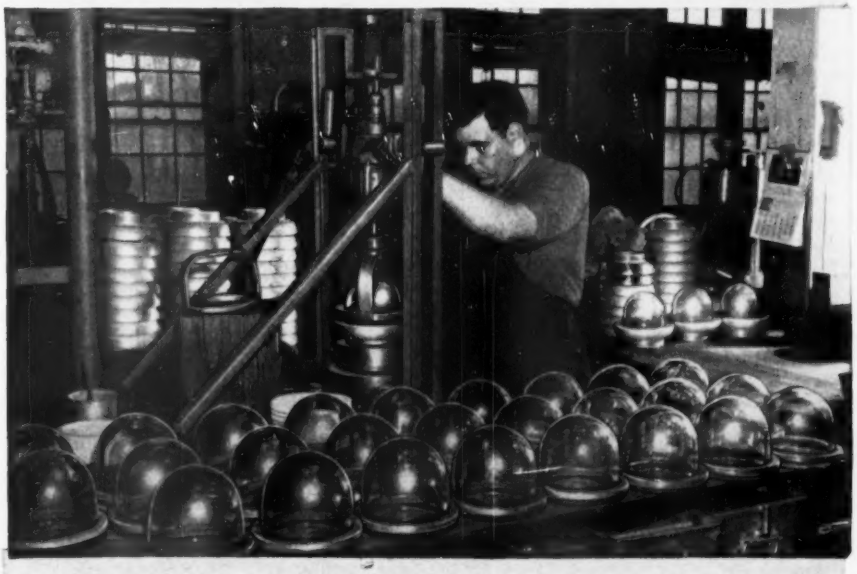
CONDULETS · TRAFFIC SIGNALS

tops in quality to last longer



One machinist operates two semi-automatic tapping machines, each of which threads four Condu'et hubs simultaneously to insure perfect alignment of the final conduit installation.



Pneumatic wrench is adjusted to provide exactly right amount of torque to fasten globes rapidly and securely into globe holders for explosion-proof lighting fixtures.

Type EVA Explosion-Proof Lighting Fixture

Type FLB Explosion-Proof Circuit Breaker Condulet

Type ARE Plug Receptacle With Spring Door

Type LBH Explosion-Proof Condulet For Pulling Cable

Type GUAC Explosion-Proof Junction Condulet

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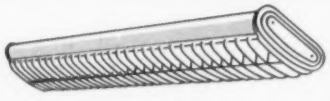
•Try 24 *Sylvania Fluorescent Lamps* of any popular type and if in your opinion, they don't give more light and maintain color and brightness for a longer time than any other brand, your money will be refunded.



•*Sylvania Fluorescent Lighting Fixtures* are covered by a *complete one year guarantee* under normal use conditions . . . this includes Sylvania fluorescent lamps, starters, ballasts and all parts originally installed with the fixtures.

•*Sylvania Starters* are *guaranteed* for an *entire year* to give the best possible performance or your money back. They are ETL certified; bear the UL label; and are approved by the C.S.A.

"Off-the-Shelf" DELIVERY USING THESE STANDARDIZED COMPONENTS

Square D

MHP DISTRIBUTION PANELBOARD

So Easy to Order, Stock and Assemble!

DESIGN LEADERSHIP

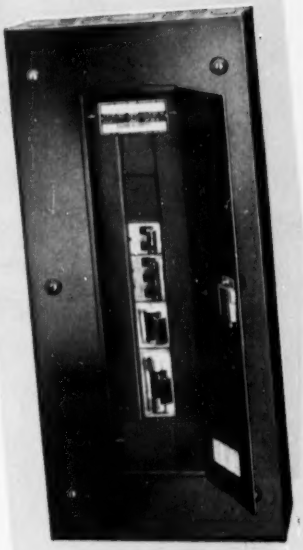
See Square D's MHP CIRCUIT BREAKER DISTRIBUTION PANELBOARDS for 240 Volt, Single Phase, 2 or 3 wire or 3 Phase, 3 or 4 wire distribution systems. Varying job requirements can be met by using different combinations of standardized components available from Electrical Distributor stocks.

1 INTERIOR consists of three cylindrical bus bars, neutral plate and necessary barriers firmly supported on an insulated steel pan and equipped with a breaker-retaining trim plate held in place by four thumb screws. Unused breaker mounting space is covered by a scored sliding plate. Extra plate length is easily broken off.

2 "PLUG-IN" BREAKERS are thermal-magnetic. Positive pressure jaws tightly grip round bus bars. Available in 15 to 100 amperes, 240 volts A.C., two and three pole common trip units, for motor loads—15 to 50 amperes, 120 volts A.C., two individual trip single poles per unit, for lighting loads.

3 TRIM has door with directory frame and flush lock with standard keying. Available flush or surface.

4 BOX is 5¾" deep and either 14" (single row) or 20" (double row) wide. Available in four basic lengths with ample knockouts and large wiring gutters.



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SQUARE D COMPANY

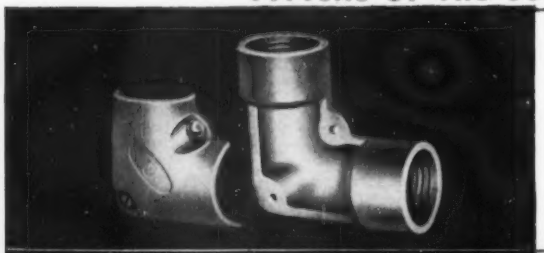
1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953

FOR CORNER PULL-IN ELBOWS, 3-PIECE CONDUIT COUPLINGS, PIPE STRAPS—CLAMP BACKS—NEST BACKS

GEDNEY *ALWAYS!*

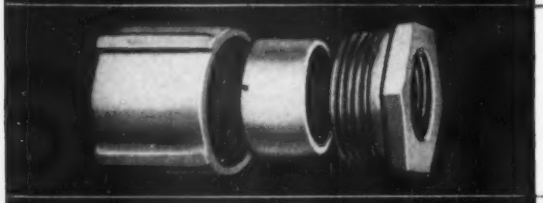
NATURALLY you want to cut installation time and costs. And you'll do it easily with Gedney Fittings, for these fittings are accurately machined and threaded, smooth finished, individually inspected to ensure top quality. What's more, Gedney Fittings are made of unbreakable malleable iron. For best profits, order Gedney always!

TYPICAL OF THE COMPLETE GEDNEY LINE ARE:



Corner Pull-In Elbows in ½", ¾" and 1" sizes. Ideal for space-saving, machine wiring, easy wire pulling. Cadmium plated.

Now available in 1¼", 1½" and 2" sizes



3-Piece Conduit Couplings in a large range of sizes from ½" to 6". Cadmium plated.

One-Hole Pipe Straps, Clamp Backs, and the handy new Gedney Nest Backs. These supplementary spacers nest firmly behind the Clamp Backs—use as many as you need to hold pipe at desired distance from wall. Hot dip galvanized to prevent corrosion.

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Foundry, Factory and Shipping Point: Terryville, Conn.

"SCOTCHLOK" CONNECTORS NOW IN THREE SIZES!

You only need three sizes of "Scotchlok" Electrical Spring Connectors to splice many different wire combinations: wire gages from 18 AWG to 6 AWG.

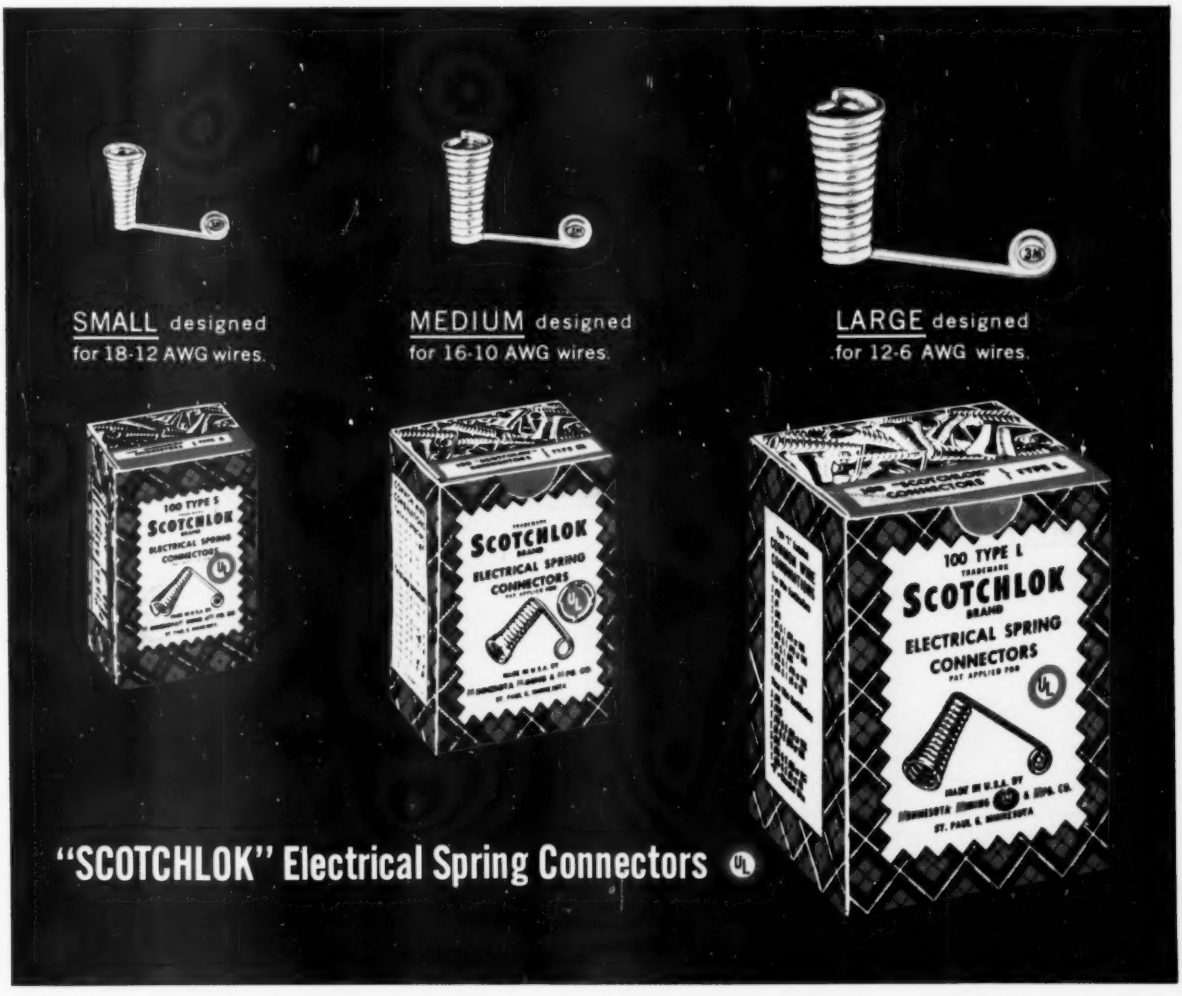
And every one of those splices will be *safe* and *compact* because "Scotchlok" is the tightest-gripping wire connector on the market. It will not shake loose. (Removes easily by squeezing the "bell" end with pliers and unscrewing.)

Cut-away of splice shows "Scotchlok" gripping power

Look how little space "Scotchlok" takes, too. Hugs those wires tight—actually *threads* the wires for extra-strong grip.

Easy to apply: twist on "Scotchlok" and wrap with "Scotch" 33 Plastic Electrical Tape.

Try "Scotchlok" yourself and see! Ask your supplier for the newest twist in splicing. Ask for "Scotchlok" today!



The term "Scotch" and the plaid design are registered trademarks for the more than 300 pressure-sensitive adhesive tapes made in U.S.A. by **Minnesota Mining & Mfg. Co., St. Paul 6, Minn.**—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

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says Fred L. Baumeister
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As if by magic, an aluminum alloy tower of any height desired is ready in minutes! Individual scaffold sections are set one on top of the other. Sections lock into place instantly.

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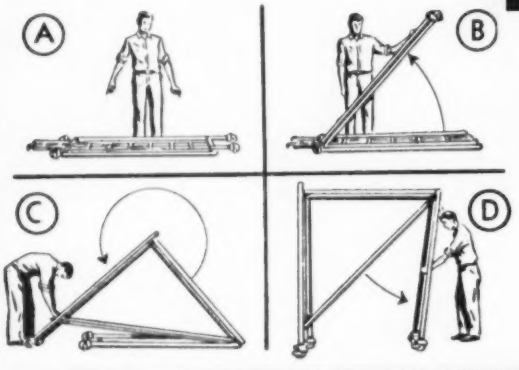
Each one-piece section is unfolded by one man in less than a minute! No tools, wing nuts or bolts.



Your maintenance costs can be reduced by "UP-RIGHT" SCAFFOLDS

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Factories: Berkeley, Calif. & Teterboro, N. J

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when cost competition is tough, you can make "DIVIDENDS UNLIMITED" with Ramset Fastening System for anchoring into steel or concrete

With tighter competition for every job, super-speed RAMSET SYSTEM offers one sure way of cutting installation time and expense. You can figure the lowest "fastener-in-place" cost to help you get more business, at a profit.

For most work, nothing tops the new PLUS-POWER JOBMASTER, with two quickly interchangeable barrels, for ¼" or ⅜" fasteners. You save ⅓ on powder loads because it uses light-duty loads for many medium and heavy-duty jobs.

Tru-Set Fasteners, in 6 types and 60 sizes, give widest choice and utility. Exclusive Red-Tip Pilots and adjustable Roto-Set Shield guide them straight to the work with hair-line accuracy, for still greater economy without waste.

Whether your work calls for ¼", ⅜" or ½" fastenings, RAMSET SYSTEM aids you to out-quote competition, and pays "DIVIDENDS UNLIMITED" on a very small investment.

Ask your dealer to help you cut costs with RAMSET and give you an on-your-job demonstration and proof. Or, mail the coupon.

Pioneer and Leader in powder-actuated fastening. Preferred by users 2-to-1 over all other makes combined. For six years, RAMSET SYSTEM has paid "DIVIDENDS UNLIMITED" to thousands of users because of ease, speed, economy and utility.

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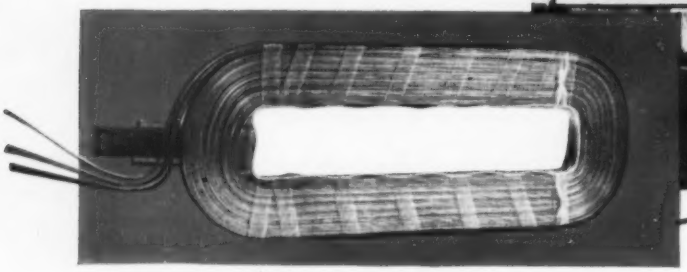

This secondary coil shows the rugged construction used to insure proper operation under all service conditions. Natvar Varnished Fiberglas Tape and Sleeving are used to insulate and protect coils and leads from moisture and heat.

This UNITOR AC Arcwelder provides a welding current of 600 amperes at 40 volts load voltage on a 50% duty cycle. Heat range can be controlled either at the unit or from the operator's stand, from maximum down to 100 amperes at 25 volts. The unit can be moved close to the job so that long ground and electrode cables are not required.

UNITOR A. S., Oslo, Norway, manufactures a complete line of AC Arcwelders which can be easily moved from job to job. Since service conditions vary widely, these units are designed and built to operate in spite of severe moisture, corrosion, heat, and vibration.

Transformer coils and leads are insulated and protected with Natvar Varnished Fiberglas Tape and Sleeving because of its uniformly high performance under adverse conditions. Natvar agent and distributor for Norway is C. Bagges Asbestkompani A.S., Radhusgt 6, Oslo.

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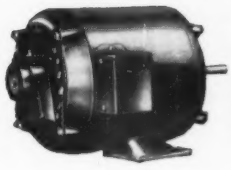
From the Wide Range of Types of . . .

In Sizes From 1/8 to 400 Horsepower



SINGLE PHASE:

Split Phase Induction—⅛, ¼, ⅓ H. P.

Capacitor—⅛ to 20 H. P.
Repulsion start, brush lifting, induction—½ to 20 H. P.

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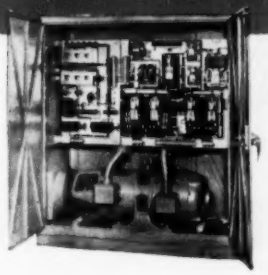

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A complete line of adjustable speed drives for coordinating all kinds of production processes.

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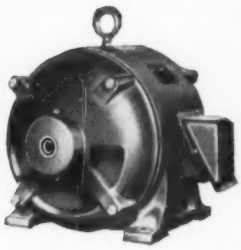

POLYPHASE:

Squirrel Cage Induction—⅛ to 400 H. P.

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Wound Rotor—6-3P1
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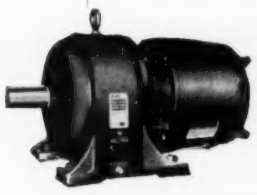

GEAR MOTORS:

⅛ to 15 H. P., single, double and triple gear reduction.

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All capacities—⅛ to 300 H. P.

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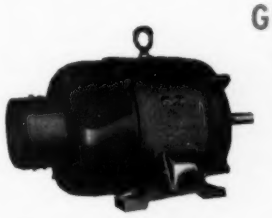

GENERATORS:

AC, .63 to 250 KVA
DC, .75 to 200 KW

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CE-825

Motors listed above are available in Open Rated Drip Proof, Splash Proof, Totally Enclosed Fan Cooled and Explosion Proof frames—and with a dozen different methods of mounting. They are unusually quiet starting and running and unusually free from vibration.

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Westinghouse unconditional lighting fixture warranty

You name the terms . . . we'll back you up! This seal places an unconditional warranty as to workmanship and material on Westinghouse lighting fixtures for the life of your own installation guarantee.

A job well done deserves to be backed up, whatever the length of guarantee. Your guarantee expresses confidence in the quality of your work. That's why we go beyond the limits of the usual term guarantee. We believe in the quality of Westinghouse lighting fixtures. We'll match—with a warranty on our lighting fixtures—your installation guarantee to customers.

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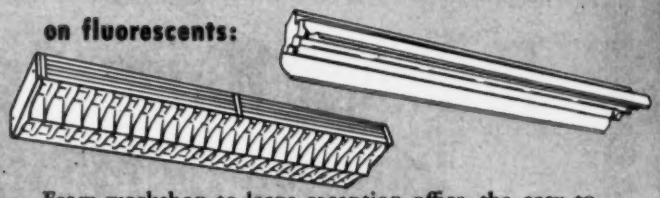
good for the life of your contractor's guarantee

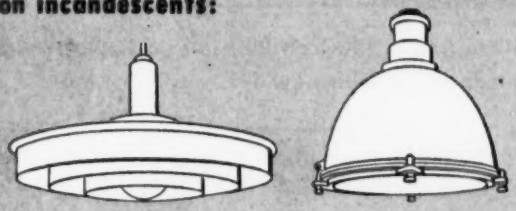
You install 'em we back you up

on fluorescents:



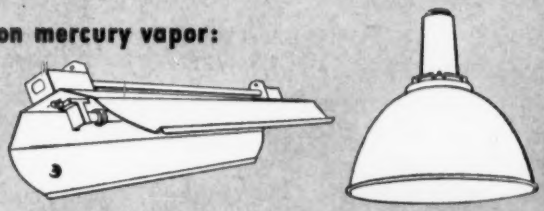
From workshop to large reception office, the easy to select and install Westinghouse fluorescents are built to last.

on incandescents:



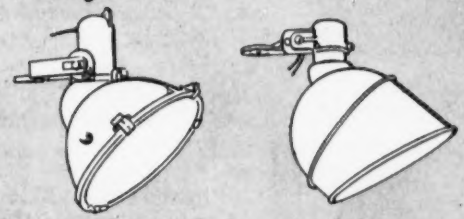
In clean or dirty locations, high or low bay areas, commercial or industrial buildings, Westinghouse incandescents fit every lighting need – with a long, outstanding service record.

on mercury vapor:



A complete line of fixtures – exclusive with Westinghouse – has zoomed to the front in industrial areas. They are easy to install – easy to maintain – designed to cut lighting costs.

on floodlights:



Built to weather outdoor service from construction projects to sports floodlighting jobs, Westinghouse floodlights are famous for ease of installation – dependable operation.

Sure – I want to know all about the new Westinghouse Lighting Fixture Warranty. Send me the simplified Selling Kit and Warranty Book.

FIRM NAME _____

MY NAME _____ TITLE _____

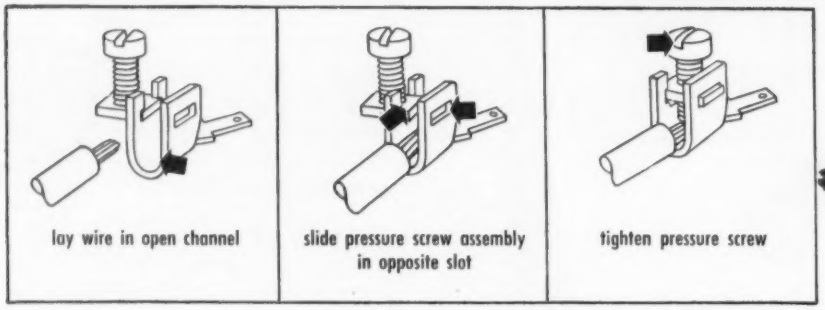
ADDRESS _____

CITY _____ STATE _____

To Reduce Wiring Costs...Save Time... Improve Installation Efficiency

THE ANSWER IS BRYANT WIRING DEVICES

50 Ampere, 250 Volt Range and Power Receptacles with new Pressure Terminals*



No. 3826
Surface Mounting

No. 3846
Flush Mounting

On-the-job wiring costs can now be reduced when you use Bryant Surface and Flush Mounting Range and Power Receptacles with new Pressure Terminals. You'll find that the finished job is more efficient . . . easier to wire . . . more satisfactory to your customers. With these cost-cutting pressure terminals —

. . . there are no loose parts to mislay

. . . the screw assembly is permanently attached to the wiring channel

. . . rounded channel confines wire strands

. . . the assembly terminals are cadmium-plated for either copper or aluminum wire

Specify Nos. 3826 or 3846 for your next range or power receptacle installation. Look to Bryant for quality-built wiring devices that mean better jobs and lower costs right down the line.

BRYANT
SUPERIOR WIRING DEVICES

Listed by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY

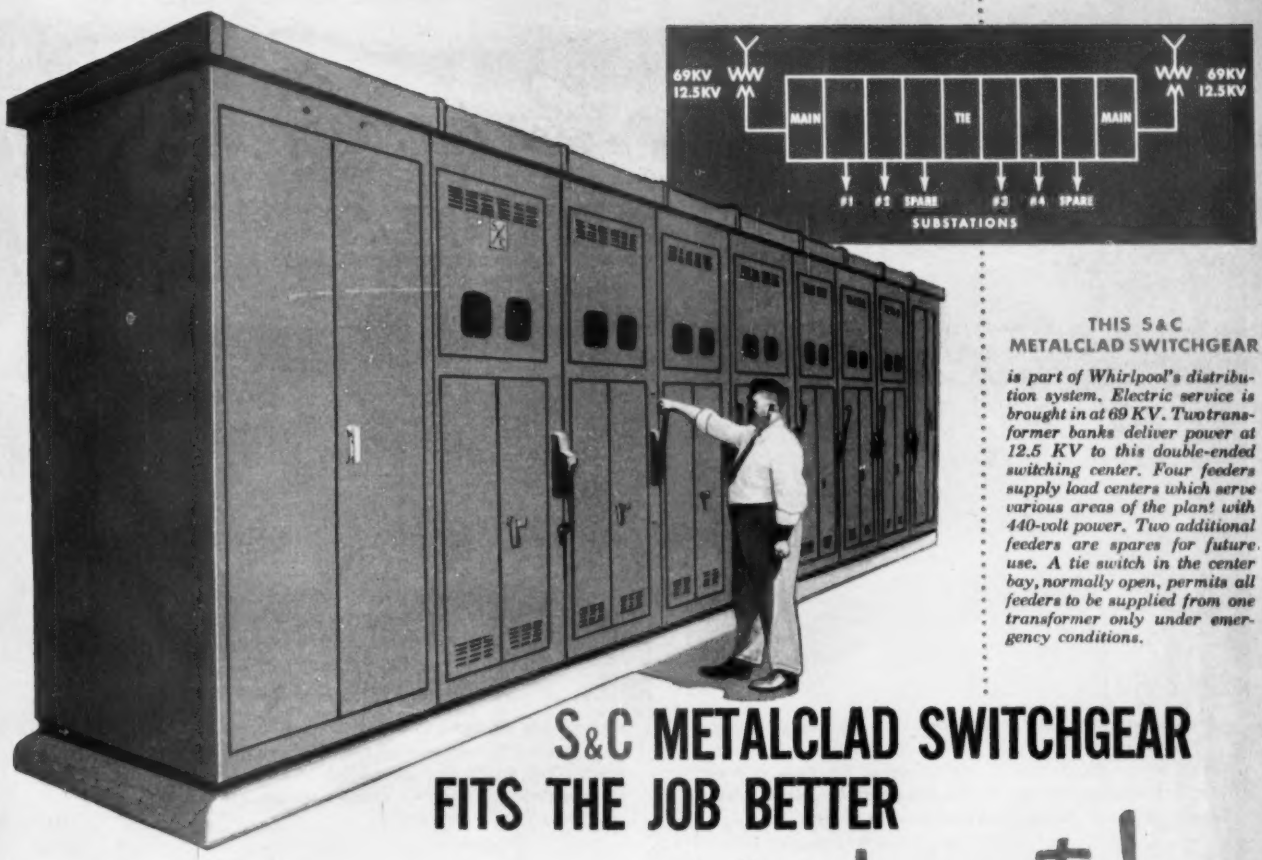
Bridgeport 2, Connecticut

Chicago • Los Angeles

Specify Bryant from your Electrical Distributor

*Pat. Pending

J-99898



THIS S&C METALCLAD SWITCHGEAR

is part of Whirlpool's distribution system. Electric service is brought in at 69 KV. Two transformer banks deliver power at 12.5 KV to this double-ended switching center. Four feeders supply load centers which serve various areas of the plant with 440-volt power. Two additional feeders are spares for future use. A tie switch in the center bay, normally open, permits all feeders to be supplied from one transformer only under emergency conditions.

S&C METALCLAD SWITCHGEAR FITS THE JOB BETTER

...and it saves half the cost!

When Whirlpool Corporation recently acquired a plant in LaPorte, Ind., for the manufacture of aircraft parts, a new electric service had to be provided to meet the new requirements.

Koontz-Wagner Electric Co., Inc.—contractor-engineers of South Bend—were assigned to engineer and install the necessary equipment.

As part of the main substation, Koontz-Wagner selected S&C Metalclad Switchgear to provide fault protection and switching . . . because investigation showed it was not only adequate for every need, but that alternate equipment would have been larger and more cumbersome, required more ground area, a larger pad, and would have cost more to install and maintain.

With S&C Switchgear the cost was less than half; and now there are no batteries to maintain, no oil to change.

Information about S&C Switchgear is contained in this booklet . . . we would like to send you a copy.

ROBERT L. PFEIL

is Secretary and Assistant Construction Superintendent of Koontz-Wagner. He says, "Our work is almost altogether connected with industrial plants and public buildings. Because of our long and valuable experience in this field, we prefer to do our own engineering, and give our customers full advantage of our experience and know-how. We thus can be sure that the installation is entirely adequate, and frequently we are able to make substantial savings, as we did at Whirlpool."

S&C Electric Company
4433 Ravenswood Ave., Chicago 40, Illinois

Please send me your new booklet on S&C Metalclad Switchgear. No obligation on my part, of course.

Name_____ Title_____

Company_____

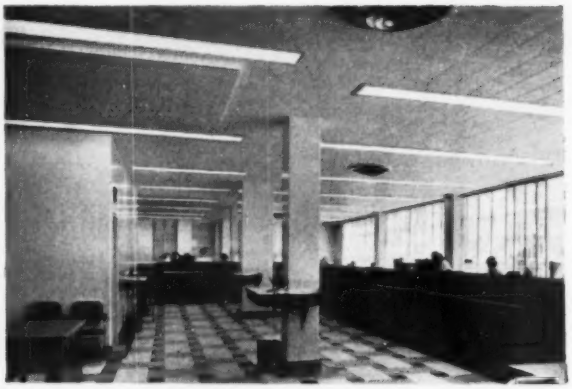
Address_____

City_____ Zone____ State_____

Why did these Banks choose LITECONTROL?

To match new (rear) and old (foreground) pleasantly, cool-white and warm-white fluorescents blend with incandescents in the chandeliers. Color quality of the walls is even throughout. LITECONTROL 9034 fixtures with Holophane lenses assure efficiency, easy maintenance, low-cost beauty.

(State Savings Bank, Hartford, Conn.)

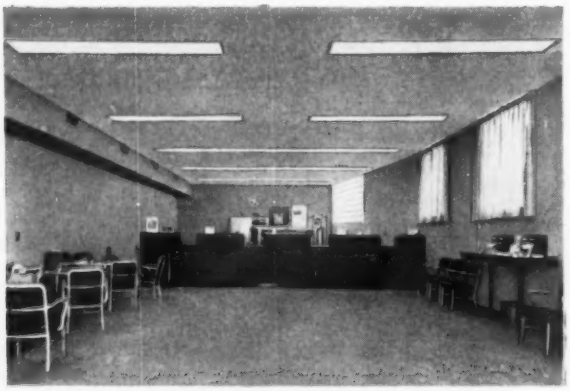


For plenty of light that's easy on eyes, these LITECONTROL 5938 recessed fixtures give 60 foot-candles initial average intensity. Yet there's very little brightness any way you look. LITECONTROL encourages a pleasant atmosphere that attracts customers, is nice to work in.

(Hartford Connecticut Trust Company, Hartford, Conn.)

To keep busy eyes sharp all day, LITECONTROL 5128 2-lamp recessed slimline fixtures give 65 foot-candles average initial intensity. Holophane lenses prevent glare or harsh contrasts. Hinged doors with simple *snap-lock catches* open and close at a finger's touch.

(Union Trust Co., Market Street Annex, Springfield, Massachusetts)



To give a clear, uncrowded look to this branch, despite its small size, LITECONTROL makes ease for eyes without desk lamps, glare or distracting shadows. Long fixtures give more light over the working area, short ones give the right light over the public. Easily maintained, very efficient.

(Society for Savings, East Hartford Branch, East Hartford, Conn.)

★

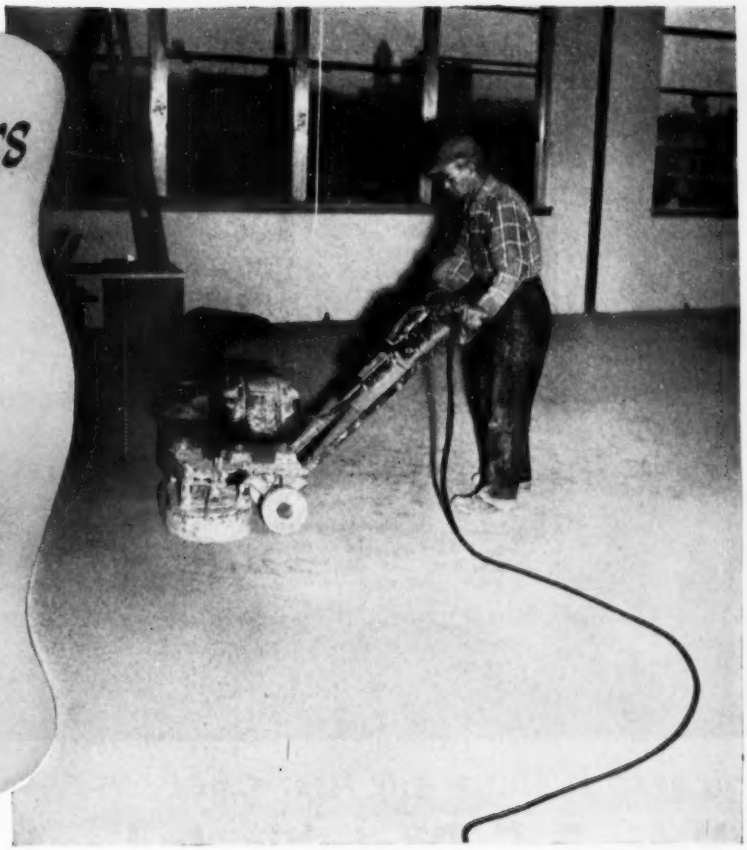
To get light that's right for efficiency, economy and beauty *at standard prices* (there's a fixture for every illumination need), call your local *Litecontrol* man.

New Catalog No. 54 is out.
Write for your copy today.

LITECONTROL
Fixtures
LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

Manufacturers hang their reputations on TIREX CORDS



Manufacturers hang their reputation on Simplex-TIREX Portable Cords and Cables because they know these cured-in-lead cords will give maintenance crews long-time service under the tough operating conditions provided by floor sanders, polishers, scrubbers, waxers, etc.

The man seen in the picture above is grinding down the floor of a new office building. He expects *and gets* reliable power when he uses TIREX selenium-neoprene armored portable cords and cables.

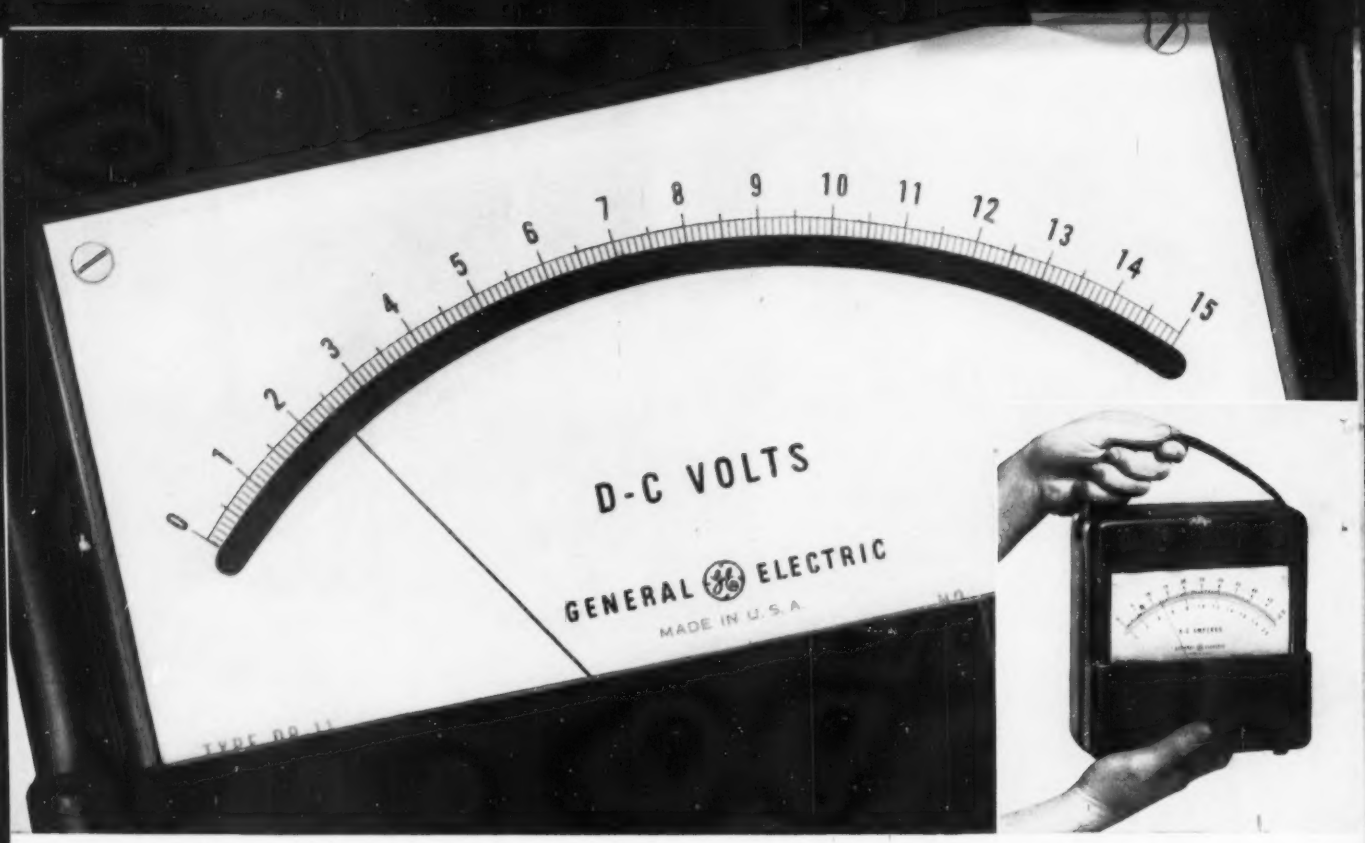
All TIREX Portable Cords and Cables have an extra-tough selenium-neoprene armor combined with the *cured-in-lead* process to make them last longer. They offer excellent resistance to abrasive dust, water, waxes, detergents and washing powder.

There is a type and size of Simplex-TIREX Portable Cord and Cable for all your portable electrical equipment. More complete information may be obtained from your nearest Simplex representative or by writing to the address below.

Simplex WIRES & CABLES

TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts

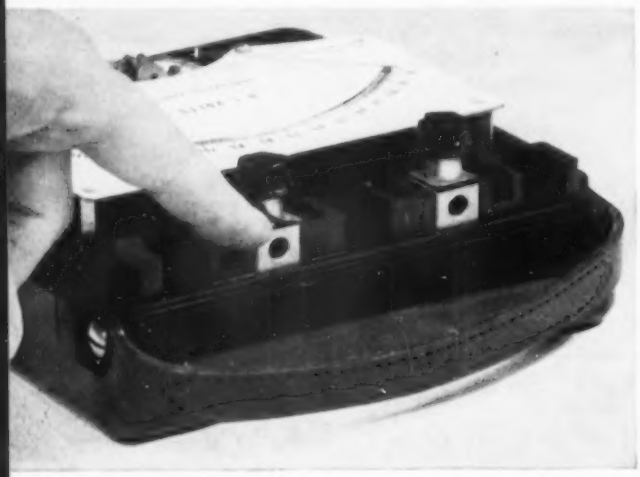


YOU READ IT RIGHT—THE FIRST TIME . . .

New G-E Portable Indicating Instrument Designed to Reduce Costly Reading Errors

No matter how high the rated accuracy of a testing instrument may be, operator errors in reading that instrument give you costly false reports.

General Electric's new line of d-c portable indicating instruments offers you the surest way of controlling these expensive reading errors. Designated Type DP-11, the design of these instruments eliminates the factors which tend to encourage false readings.



NEW REAR-SET TERMINALS accept many connector types—spade, plug, others; reduce twisting of leads, high-potential hazards.

IMPROVED READABILITY

The dial of the DP-11 indicator is a long, readable 5½ inches. Figures are legible and liberally spaced for quick positive reading.

Readability is further increased by the molded plastic window, which permits flooding the entire scale with light from the front and three sides—to eliminate shadows.

MANY TYPES AVAILABLE

You can get the DP-11 in any one of several ranges and types—as ammeters, voltmeters, millivoltmeters, milliammeters, or microammeters. Rated accuracy is within ½ of 1% of full scale.

Twin to the DP-11 line is the new DP-12 instrument group—for those applications where an accuracy of ¼ of 1% is desired.

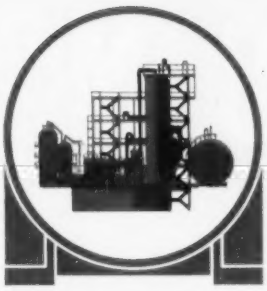
MORE INFORMATION

For further details on how the DP-11, -12 instruments can help you to speedier, surer measurements, contact your G-E Apparatus Sales representative or write for Bulletin GEC-979 to Section 602-266, General Electric Company, Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

Fuel Pumping



Petroleum Refining

Chemical Processing

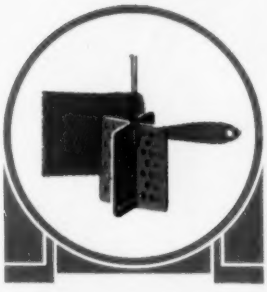
Electric Motors

for every industry

When you need electric motors . . . in any rating, or frame type . . . one or a thousand . . . *always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry.

Fairbanks, Morse & Co., Chicago 5, Illinois.

Pipe Line Pumping



Paint Manufacturing

Fairbanks-Morse explosion-proof motors for all installations where fire hazards exist.

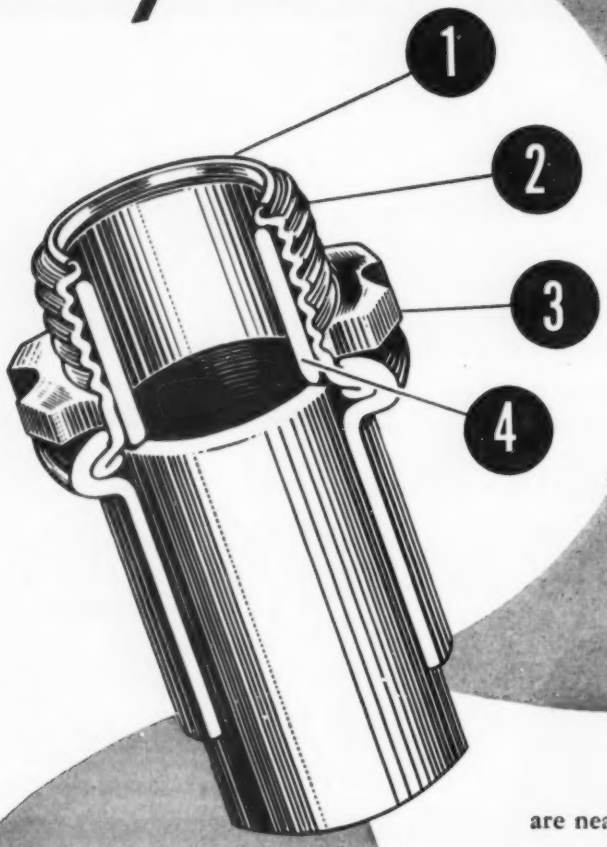
FAIRBANKS-MORSE

a name worth remembering when you want the best

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • RAIL CARS • PUMPS • SCALES • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

New B-M 21 E *Connector*

HAS *4* OUTSTANDING FEATURES



1 **Smooth Rolled Edge Throat will not cut or scrape plastic insulation.**

2 **Full thread screws into all conduit fittings.**

3 **Nut screws down flush to shoulder for positive ground.**

4 **Internal sleeve same inside diameter as tubing insures smooth raceway for easy fishing.**

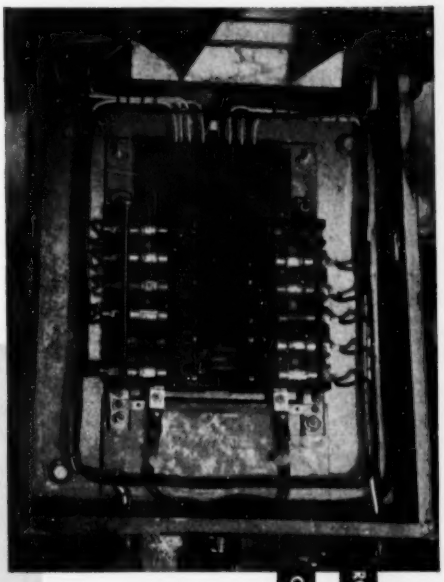
All B-M Indenter Fittings are U. L. approved as Concretetight and for General Use. (File Card E 10863)

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

How a Texas chemical company solved a tough cable requirement

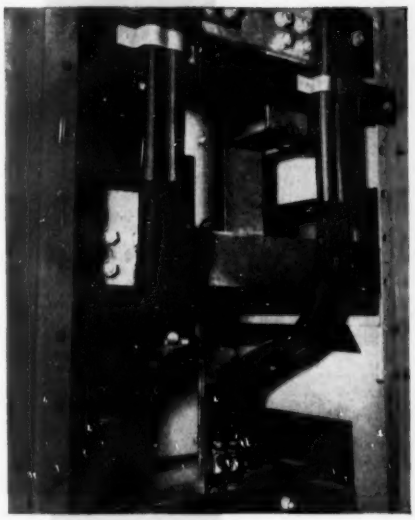


High ambient temperatures, together with corrosive fumes from acids and caustics, may cause cables to disintegrate within a few months . . . unless you've specified the correct insulation.

That is one of the reasons why a large Texas chemical company specified Rome Synthinol® 901 insulated wire and cable for plant wiring. This special compounded polyvinyl chloride insulation provides *exceptional resistance* to acids, oils, corrosive fumes, greases, moisture, and heat deformation for most applications through 600 volts.

Its performance has been so good that it is now one of the most frequently specified cable insulations for chemical plants, oil refineries, paper mills, steel mills and similar industrial plants. Ask your purchasing department to check this.

You will save time and money on the installation of Rome Synthinol 901. It is uniform in diameter and easy to pull. Permanent color coding helps to identify circuits quickly.



Rome Synthinol 901 Insulated Wire Approvals

Appliance Lead Wire—Underwriters approved for 600 v. at 90°C. through size No. 4/0 AWG. Approved for 105°C. on smaller sizes No. 24 through No. 16 AWG.

Type TW—Underwriters approved as Type TW for 60°C. operation, under the National Electric Code. High resistance to heat means greater safety factor at elevated temperatures.

Machine Tool and Control Wire—Underwriters approved as Type TW, with end use approval for 90°C. operation in air; 60°C. where exposed to oil and in wet locations. Conforms with National Machine Tool Builders' Association standards. Resistant to extreme ambient temperatures, acids, oils, cutting solvents and flame.

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

ROME CABLE CORPORATION, Dept. EC-11, Rome, N. Y.
Please send information on Rome Synthinol and Rome Synthinol 901

Name.....

Company.....

Address.....

City..... Zone..... State.....

Neither Explosion nor Fire could destroy this KILLARK *Explosion Proof* Fixture

Unscheduled but dramatic proof of Killark's rugged durability and safety-plus design came out of the ruins pictured above.

Both explosive gases and fire joined forces to produce this plant-wide destruction—bricks were literally evaporated under the heat, beams were twisted into grotesque shapes, large tanks were hurled to distant points.

In the *very center* of this broad devastation was the Killark fixture shown here in the unretouched photo! Excluding the sheet metal reflector, of course, the body of the fixture itself came through undamaged—in *still-usable* condition. The gaskets and the seal-off section were still intact, the globe was in perfect condition—there was no invasion of fire into the conduit.

A more severe test for any fixture would be hard to imagine—yet this is the kind of day-in-day-out protection built into every Killark Explosion-Proof Fixture.

Less spectacular perhaps, but just as important to long-life installations, are these other Killark advantages: rust and corrosion proof Alumalloy construction; smooth attractive finish; light in weight but strong in service; always safe and non-sparking, yet cost no more than ordinary iron fittings.

K KILLARK ST. LOUIS

Killark

"KILLARK—a Fitting Name to Remember"

ELECTRIC MANUFACTURING COMPANY

IF IT'S PARANITE®
IT'S the RIGHT Wire and Cable

PARAFLEX Non-Metallic Sheathed Cable lays flat. Won't squirm or twist. Clean to handle. Plainly marked.

PARAUSE® Type "RR" cable provides permanent underground installation from power line to meter and for connecting several buildings. CAA approved under Specification L824.

HYDRO-THERM® Building Wire combines in a single wire the heat-resistant qualities of Type RH and the moisture resistant qualities of Type RW.

URC Weatherproof Wire and Cable can be relied upon to meet severe climatic conditions. Both actual line and Weather-Ometer tests prove unusual ageing characteristics.

SERVICE ENTRANCE CABLE, Type SE Style U unarmoured and Type SE Style A armoured. There is also a Paranite Service Drop Cable, two conductor, Type SD.

DREADNAUGHT® Heavy Duty Cable has lead-cured neoprene insulation. Flexible, durable, safe, long-lived. Cuts repairs and replacements. Delivers current continuously.

IF IT'S **PARANITE®** IT'S RIGHT!

PARANITE WIRE AND CABLE
Division of ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA

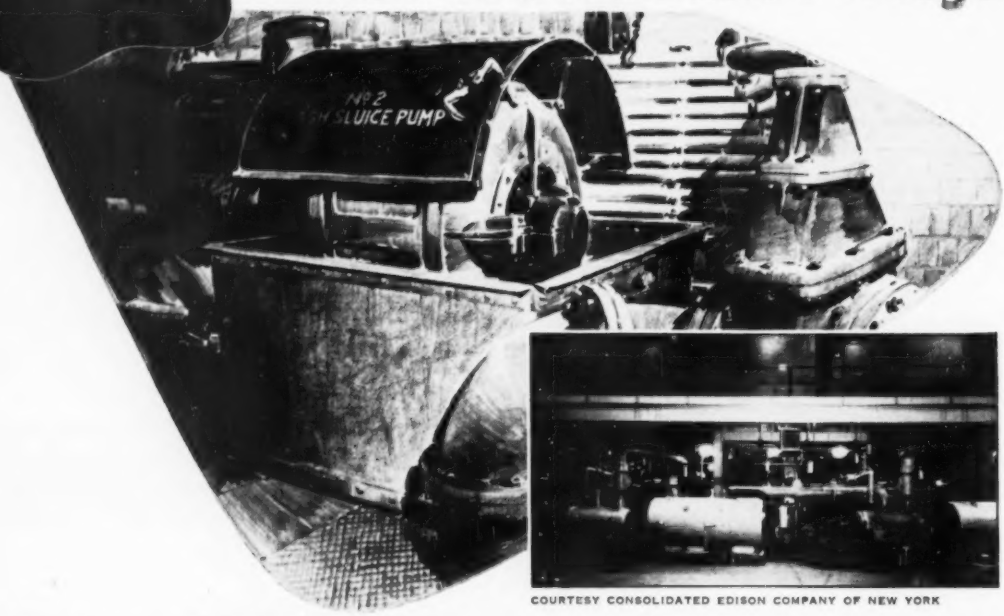
WIRES AND CABLES SINCE 1890

EXPORT SALES OFFICE—LIONEL-ESSEX INTERNATIONAL CORPORATION, 15 E. 26th ST., NEW YORK 10, N.Y.

ELECTRICAL WIRES AND CABLES *"BETTER THAN CODE REQUIRES"*

DOW CORNING
SILICONES

make motors last longer



COURTESY CONSOLIDATED EDISON COMPANY OF NEW YORK

World's Largest Utility Specifies Class H Insulation for Reliability

When millions of customers depend on you for 24 hour a day service, you can't take chances with your equipment. That's why the Consolidated Edison Company of New York took immediate action when a 350-hp Class A insulated sluice pump motor failed 3 times in one year.

Although repeated overloading was the primary cause of failure, ambient temperatures were kept high by an enclosure built around the motor for flood protection. Failure rate was cut to once a year by rewinding with Class B insulation. The motor was then rebuilt with Class H (silicone) insulation. That was 9 years ago, and it is still in service.

That was Consolidated Edison's first experience with Class H. Since then, many other motors have been rewound with Class H to withstand tough operating conditions. Over 79% or 71,700 out of a total of 90,500 horsepower in new motors bought for major auxiliary installations have been Class H insulated.

Consolidated Edison has also pioneered the use of Class H insulation in sealed dry-type unit substation transformers. They estimate that the cost of such units is more than competitive with conventional installations for power plant auxiliary supply. Convenient and safe, the Class H transformers can be located almost anywhere. And the cost of cable, switchgear, fire protection and related equipment is greatly reduced. That's why Consolidated Edison has already bought eighty-one 1250 KVA Class H transformers for unit substation work, and twelve 1000 KVA units for miscellaneous light and power.

No wonder engineers and management men throughout industry now specify Class H insulation made with Dow Corning Silicones to get as much as 50% more overload capacity or 10 times the life of electrical equipment built with the next best class of insulation.

mail this coupon today

DOW CORNING CORPORATION, Midland, Mich.
Please send me: **Dept. G-11**

- ☐ Performance data on Class H equipment
- ☐ Data on Silicone Grease for motor bearings
- ☐ 32-page booklet entitled "What's A Silicone?"

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COMPANY

ADDRESS

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In Canada: Fiberglas Canada Ltd., Toronto In England: Midland Silicones Ltd., London

Now!

A BRAND NEW WIRING DEVICE

for a big and Profitable Market

P&S 500-I

P&S 500

The New P&S®

No. 500

U-AD-M

DUPLEX OUTLET

The easiest, quickest, most economical way to add duplex convenience outlets to existing installations.

Entirely New . . . Unbelievably Simple

The new P&S 500 is a self-contained unit . . . No box, no extra clamps, no soldering, no taping necessary. It provides a high quality, double-grip duplex outlet that holds cap blades securely, a wall plate of most modern design and means for fastening in the wall. Everything is in a single package. Ten packages packed in an attractive display carton. Available in Brown (P&S 500) and Ivory (P&S 500-I)

Approved by Underwriters' Laboratories. Guide Card No. 365 E1, File E9664 B

For Complete Information on P & S® 500 U-AD-M Duplex Outlets Ask your Electrical Wholesaler or Write Dept. M

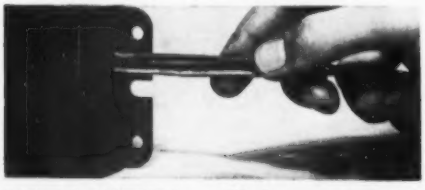
PASS & SEYMOUR, INC.

SYRACUSE 9, NEW YORK

OFFICES: 71 Murray St., New York 7, N. Y.
1229 W. Washington Blvd., Chicago 7, Ill.

Here's progress you can measure in fluorescent ballast design

IMPROVED HEAT CONDUCTION is assured when side panel is mounted in contact with channel metal.



EASIER MOUNTING is possible because of new location of leads, out of the way of mounting tools.

Lighter by half a pound and only 1¾ in. high . . . that's progress in fluorescent ballast design. These G-E two-lamp, 40-watt rapid start and standard switch-start ballasts assure both easier handling and far more compact and economical fixture design. You can count on sizeable savings in handling and shipping costs on mass production runs.

MORE EFFICIENT DESIGN gives you better ballast operation, too. For example, the long panels on either side of this new ballast case permit rapid heat dissipation into fixture channel metal when ballast is properly mounted.

NEW LEAD LOCATION makes mounting easier. Half way between center mounting slot and corner mounting holes, leads can't interfere with mounting operations.

FOR BETTER FIXTURES that are smaller, more convenient, easier to install and handle, it will pay you to use G.E.'s new shallow-height brick case ballasts for two-lamp, 40-watt applications. Contact your nearest G-E Apparatus Sales Office or authorized G-E distributor today. General Electric Company, Schenectady 5, N. Y. 412-110

GENERAL ELECTRIC

IN DUCTS . . .

. . . OR DIRECT IN EARTH

Neoprene-jacketed cable reduces installation costs . . . resists deterioration

Every day, more and more electrical engineers specify neoprene-jacketed cable for underground distribution systems. In ducts, neoprene-jacketed cable is ideal because its light weight and flexibility assure simplified installation and lower labor costs. Tough and durable, neoprene stands up under rough handling around manholes and ducts . . . withstands the effects of lubricants. Even grease and oils that may be present in old ducts present no problem.

Buried directly in the ground, neoprene resists attack from soil acids and stands up under crushing from settling earth. Unlike metallic coverings, it is not damaged by electrolytic action caused by stray currents.

Your supplier is the man to see for more information about neoprene-jacketed cable. It is available in single and multiple conductor types, in voltage ratings to meet your requirements.

NEOPRENE

The rubber made by Du Pont since 1932

DUPONT

REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

FREE! **THE NEOPRENE NOTEBOOK**

Each issue describes interesting application of neoprene . . . new products . . . on-the-job reports. Add your name to the mailing list. Just clip and mail this coupon to E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division EC-11, Wilmington 98, Delaware.

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the sign of QUALITY

I-T-E Molded Case Circuit Breakers

Whenever you buy a panelboard, you're buying much more than the attractive enclosure—the part you see. Fundamentally, you're buying protection—electrical protection—the trouble-free kind of protection that only circuit breakers provide.

Remember, too, a panelboard is only as good as the circuit breakers it encases. That's why it pays to specify the best—I-T-E circuit breakers—in your panelboards.

I-T-E Molded Case Circuit Breakers have long been recognized as the quality standard in the industry. Whatever your application—from 10 to 600 amperes—you'll find the right frame size and rating to give you complete protection. You can count on industry-proved I-T-E quality features over the entire line.

Even the *smallest* I-T-E Circuit Breaker—the new 50-ampere EQP *plug-in* design—provides all the "extras" that come with quality

3-POSITION OPERATING HANDLE
clearly indicates whether breaker is ON, TRIPPED, or OFF. Service quickly restored.

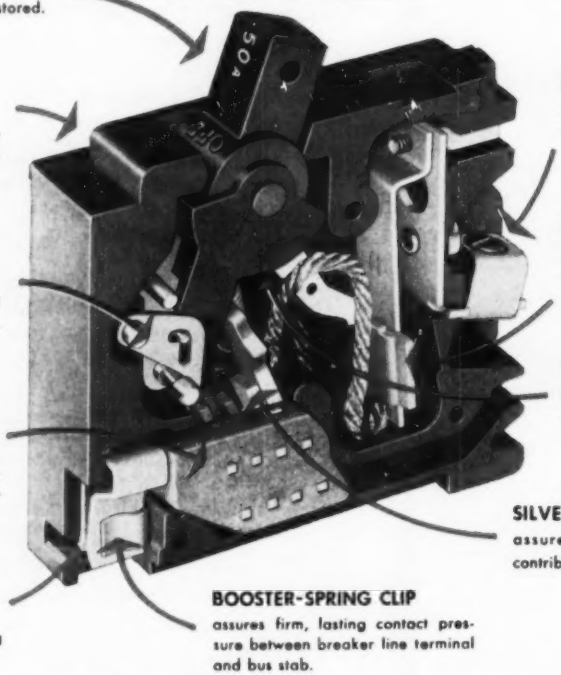
STURDY MOLDED CASE
completely encloses operating mechanism. Safe, rugged, *tamper-proof*.

QUICK-MAKE, QUICK-BREAK ACTION
on both manual and electrical operation preserves contact life.

EFFICIENT MAGNETIC ARC CHUTES
extinguish arc instantaneously. Provide high interrupting capacity.

SILVER-PLATED PLUG-IN PRESSURE TYPE CONTACTS
clip directly on bus stabs. Mounting is positive, safe.

PLATED METAL PARTS
—extra-quality feature—protect internal mechanism against corrosion.



BOOSTER-SPRING CLIP
assures firm, lasting contact pressure between breaker line terminal and bus stab.

COMPACT OVER-ALL DESIGN
reduces panelboard size up to 25%.

PRESSURE WIRE CONNECTORS
are securely mounted—easily accessible for quick connection of leads.

THERMAL-MAGNETIC TRIPPING
provides dual protection — protection against overloads and short circuits.

TRIP-FREE TOGGLE ACTION
makes it impossible to hold breaker closed against an overload.

SILVER ALLOY CONTACTS
assure minimum heat rise . . . contribute to long breaker life.

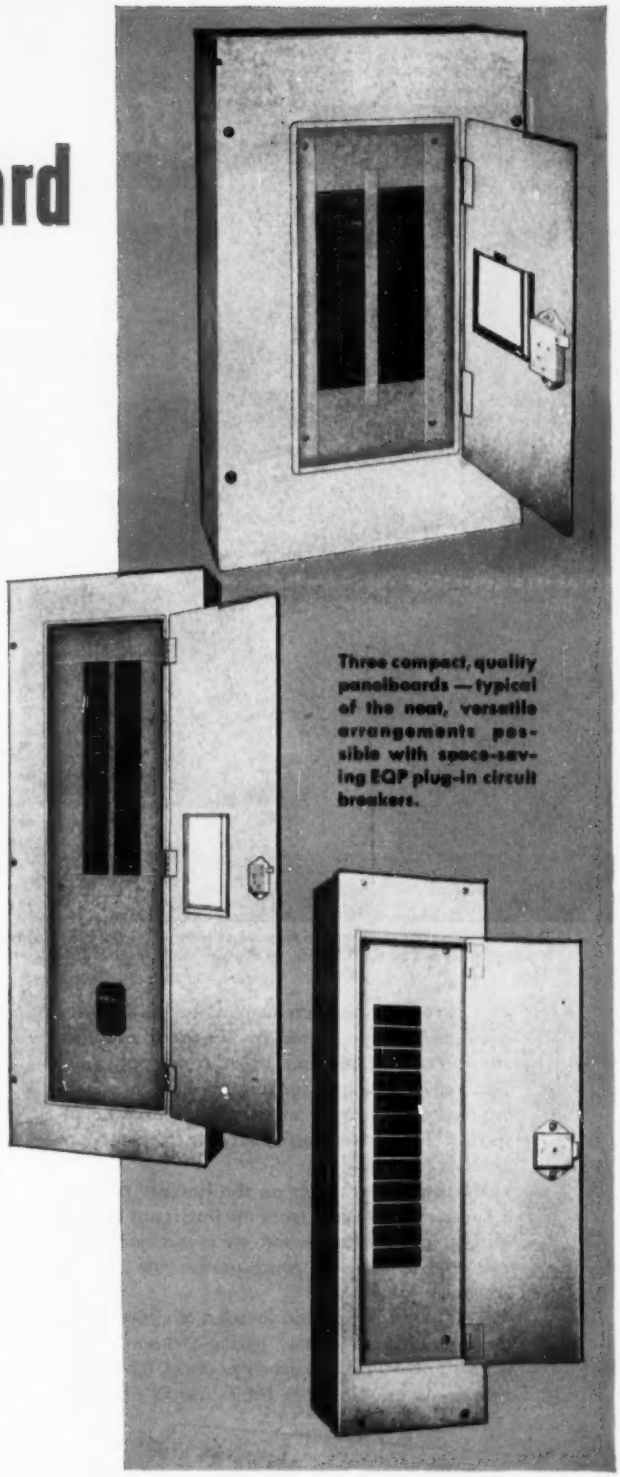
in your panelboard

Your local independent panelboard builder

can supply you with:

1. The exact type panelboards you need for every industrial and commercial application.
2. panelboards housing top-quality I-T-E Molded Case Circuit Breakers.

I-T-E Molded Case Circuit Breakers are built for incorporation in the designs of the country's leading independent panelboard builders. And there's a complete line to choose from. So be sure to order your panelboards "with I-T-E circuit breakers"—and know you have the best.



Three compact, quality panelboards — typical of the neat, versatile arrangements possible with space-saving EQP plug-in circuit breakers.

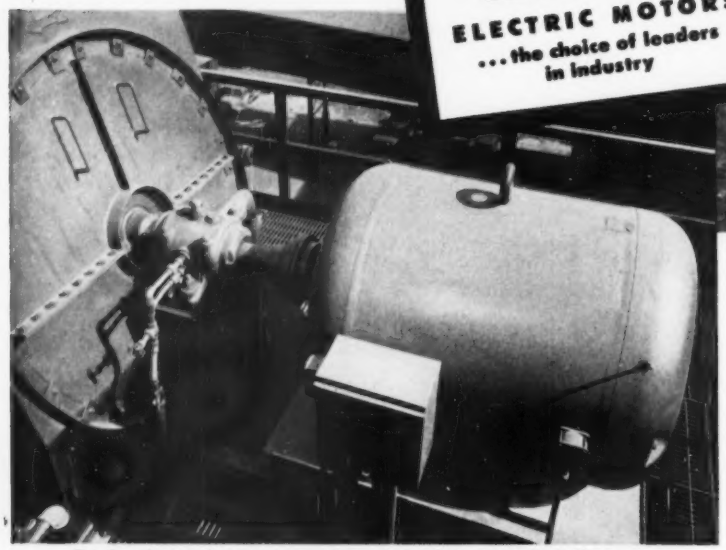
REMEMBER—

You don't have to compromise with quality to utilize the new, compact panelboards now available. Specify I-T-E circuit breakers and I-T-E panelboard construction—throughout. Your local panelboard builder will gladly give you details.

I-T-E CIRCUIT BREAKER COMPANY
19th and Hamilton Sts.
Philadelphia 30, Pa.

MOLDED CASE CIRCUIT BREAKERS

This 250 hp, 220 volt motor starts with minimum line voltage disturbance . . .



Wagner
ELECTRIC MOTORS
. . . the choice of leaders in industry

This fly ash control equipment, on the roof of a Detroit Auto Body Corporation, is powered by a 250 hp, 220 volt, 1160 rpm, totally-enclosed Wagner motor.

because it's a

Wagner

Increment Motor and Starter Combination

The part-winding increment motor and starter combination (pioneered by Wagner) provides an economical method of starting polyphase squirrel-cage motors for any application where reduced current draw at start is required or desirable. No auto-transformers or resistors are necessary.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as is the case when auto-transformers or compensator-type starters are used.

You benefit when you install a Wagner increment motor and starter "package" because you get a highly efficient, most economical, motor and starter combination that limits inrush of motor current to values that are acceptable to most power companies for all or parts of their distribution systems.

* * *

When you standardize on Wagner Motors—you get the advantages of a liberal warranty . . . of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp.) Bulletin MU-185 gives complete information—write for your copy. Bulletin MU-128 gives full information on Wagner Increment Motor and Starter Combinations.

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

® Wagner Electric Corporation
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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M-53.6

RHODE ISLAND TW Besto-Wire®

FOR YOUR BUILDING WIRE REQUIREMENTS

Rhode Island TW Besto-Wire is available in sizes from 14-gauge all the way through 500,000 circular mil... used in every type of residential, commercial and industrial construction.

Rhode Island TW Besto-Wire is a favorite with electricians on the job... easy to handle... easy to pull... provides the highest degree of resistance to heat, cold, abrasion and moisture.

Write Dept. ECM-11, today for Illustrated Brochure.

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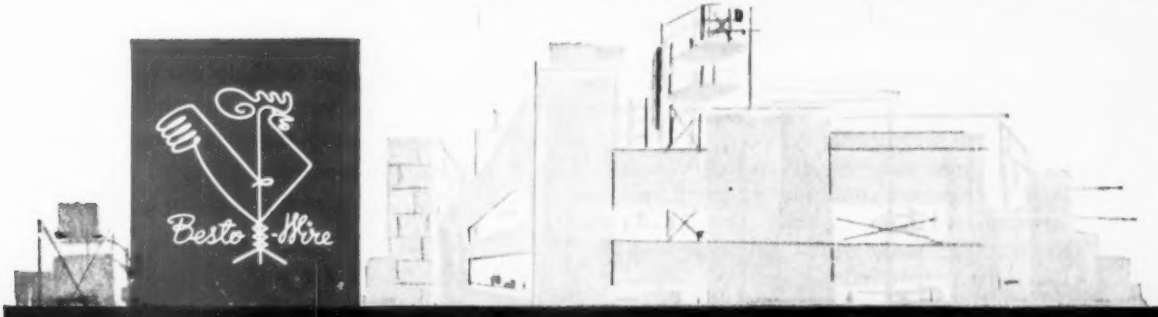
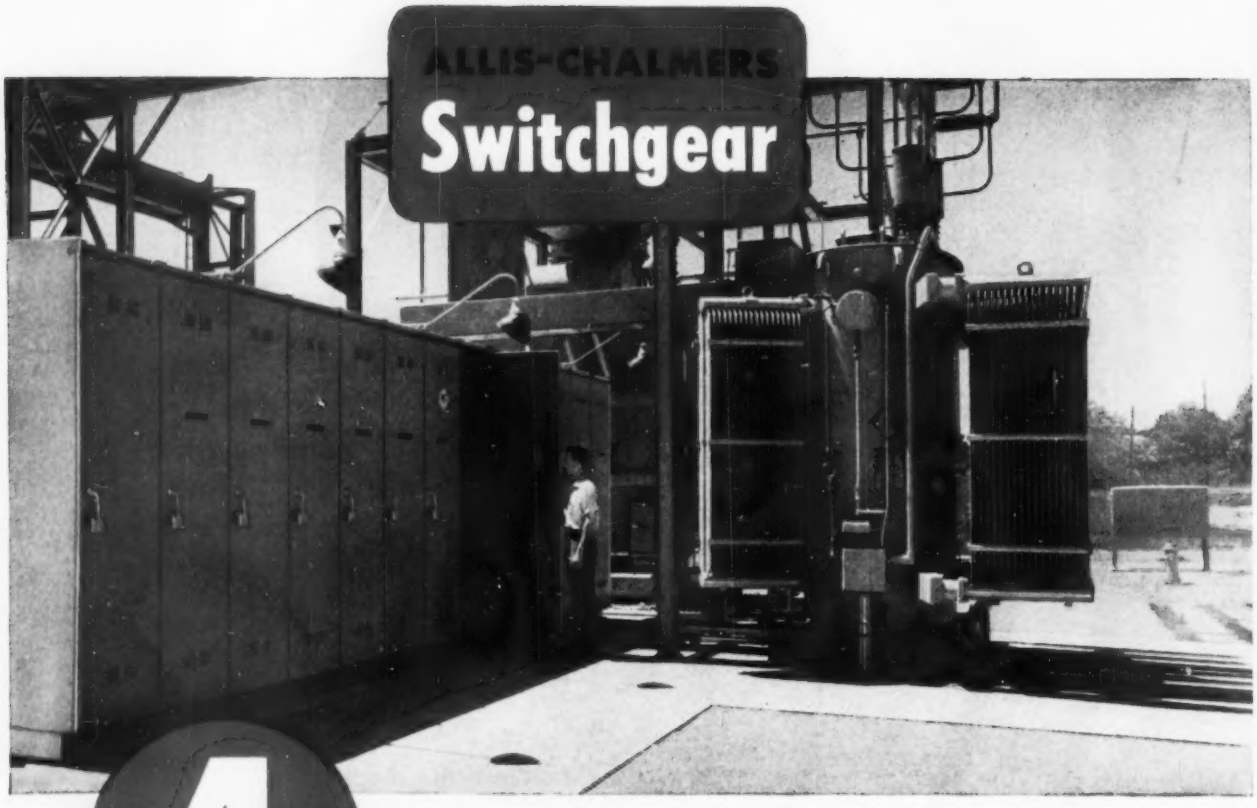


RHODE ISLAND INSULATED WIRE COMPANY, INC
50 BURNHAM AVENUE • CRANSTON • RHODE ISLAND



4 WAYS to Guard Against Power Interruption

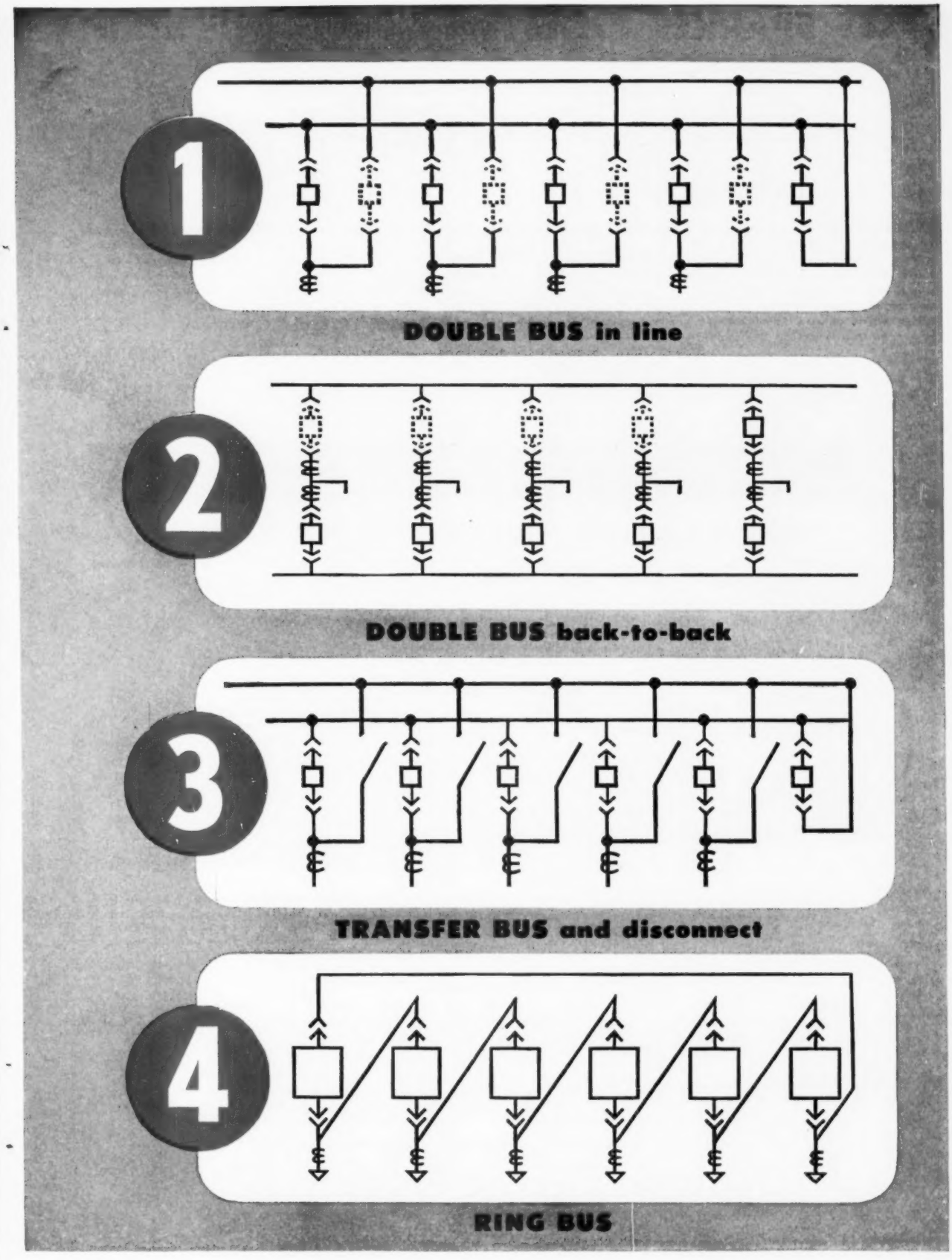
Here are a few of the many different circuit arrangements Allis-Chalmers can provide. All are designed to assure continuity of service. Each one is specially suited for specific situations.

With Allis-Chalmers switchgear, all these circuit schemes have one advantage in common. Each arrangement shown can be built into standard units of Allis-Chalmers metal-clad switchgear without adding extra cubicles. This economy and simplicity, plus the obvious space savings, make Allis-Chalmers equipment especially attractive.

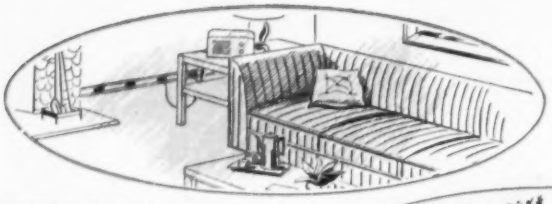
Which Arrangement is Best? A study of your problem is needed to answer this question. Any one of these arrangements may be best for your plant. Or maybe an entirely different scheme is needed. In any case, Allis-Chalmers engineers can help you work out the best scheme for you . . . one that provides ✓ economy, ✓ simplicity, ✓ space saving, and ✓ uninterrupted service.

For complete information, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4135

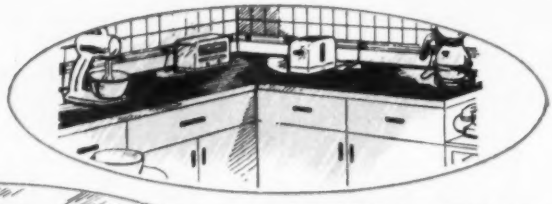
ALLIS-CHALMERS


1
DOUBLE BUS in line
2
DOUBLE BUS back-to-back
3
TRANSFER BUS and disconnect
4
RING BUS

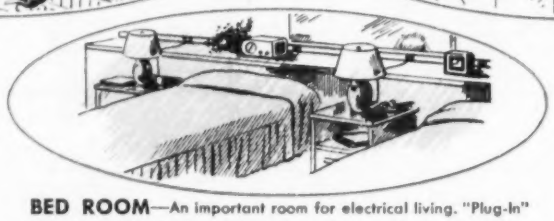
SALES SPARKER IDEAS with "PLUG-IN" STRIP



LIVING ROOM—Type CF-3 (switch controlled) "Plug-In" Strip provides a complete baseboard of outlets spaced 18" apart. Every outlet provides dual service—switch controlled at doorways or constant service. Allows absolute freedom for furniture rearrangements.

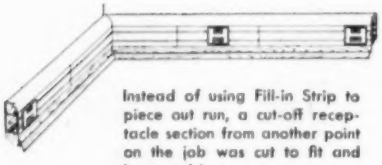


KITCHEN—Type CF 2 (constant service) "Plug-In" Strip provides a spread of outlets every 6" along the kitchen work centers. Every appliance has its very own plug-in!



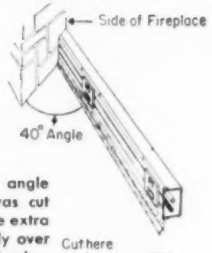
BED ROOM—An important room for electrical living. "Plug-In" Strip behind the bed provides plenty of outlets for lamps, radios clocks and heating pads.

TIME-SAVER TIPS ON "PLUG-IN" STRIP INSTALLATION

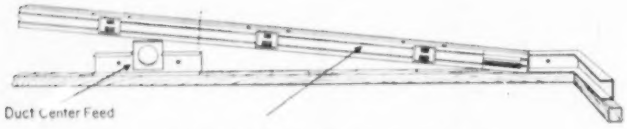


Instead of using Fill-in Strip to piece out run, a cut-off receptacle section from another point on the job was cut to fit and jumpered in.

Improvised outlet "masker" keeps paint from plugs. (Made on the job by soldering copper rod handle on to a cut out piece of scrap tin.)

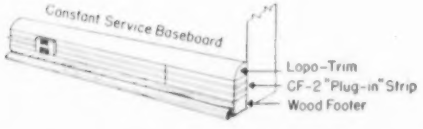


To meet this acute angle situation the base was cut back as shown and the extra capping bent squarely over for an end closure. Conductors were cut back and wire nuts applied.



Strip actually laid in position and pencil marked for a cut to fit situation. This eliminates possibility of measuring error.

Wood footer is not nailed into position until center feed base is secured and "Plug-In" Strip with clips is slid into position. This eliminates difficult driving of clips into a tightly secured footer. Finally, footer is toe nailed, drawing the whole assembly into a tight and perfectly aligned trim.



Tell your electrical contractor you want "Plug-In" Strip. It costs no more than ordinary wiring, but pays off in *more sales.*

INSTALLING THE STRIP AND FITTINGS

Connect circuit feed, with suitable connector, to base of Center Feed Junction Box and secure base in position. Install Elbow Bases and any necessary bridging End Junction Boxes.

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 Plants • 7 Warehouses • 34 Sales Offices

Washington Report

Business activity remains high in final 1953 quarter, most at near record levels, Commerce Department reported recently. Basic reasons: unemployment remains at post-war low, personal income remains high (at $287 billion annual rate at end of August), and new building construction will set a record high for the year.

Industrial production has slipped some with minor curtailment in steel, petroleum and automobile industries. Also, retail sales are down slightly, in some areas. But Commerce Secretary Sinclair Weeks predicts business activity will continue at good level well into 1954, provided the "world picture and the defense situation remains about what it is now". Reduction of personal income taxes on January 1 by about 10% is expected to result in increased consumer spending by about 5% for the first half of next year, or at an annual rate of about $10 billion.

A new Federal agency, the Business and Defense Services Administration, has been announced. It will carry out the residual defense and mobilization activities of the National Production Authority abolished October 1, which it supersedes, as well as perform a variety of services for business. It will be an operational unit within the Department of Commerce, staffed with about 400 employees, and has about $3.6 million to spend during this fiscal year (see page 248).

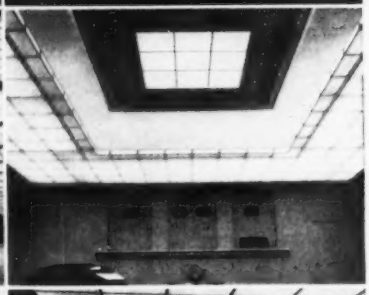
Makeup of the 1955 fiscal budget will continue to get headline attention until Eisenhower presents his budget request to Congress early next year. The military wants to hold the defense spending rate about level through fiscal 1955, or about $42 billion annually. Defense Chief Charles E. Wilson wants a cutback to about $38-to-$39 billion for fiscal 1955, and is supported by the National Security Council. Hope for a budget balance in 1955 has been abandoned, but Eisenhower is still insisting on economy to hold down size of the deficit. Congress will have the final say, but must consider the budget request in the light of reduced taxes, an economic adjustment to reduced national spending, and needs for continental defense against Russia's increasing ability to use A and H bombs against this nation.

Allotment of steel, copper and aluminum to direct defense users for the first three months of 1954 have been sharply reduced by Office of Defense Mobilization, reflecting "adjustments in military schedules", according to ODM. Compared with the last quarter of 1953, military and atomic contractors will get 20% less steel, 23% less copper and 18% less aluminum. Government has dropped controls on civilian use of nickel, effective Nov. 1.

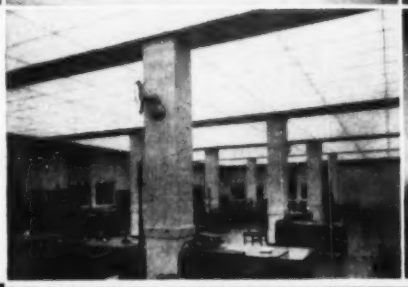
Public and private construction outlays during the first nine months this year were the highest on record. They totaled $25.9 billion, up 7% over 1952 similar period, the Commerce and Labor Departments reported. Private spending for this period was $17.5 billion, 9% above the 1952 level, while public spending (by Federal, state and local governments) amounted to $8.4 billion, up 5% over 1952.

Rapid tax amortization for protective construction to reduce bomb damage in event of an attack will be granted 100%, ODM announced recently. To be eligible for this 100% fast tax write-off, plants must undertake a project costing at least $25,000 and must be in an area listed by civil defense as "a primary target area". Protective construction is defined as sturdier buildings, which will cost about 20% more than ordinary plant construction, and are expected to reduce the area of major damage by one-third.

when the finest in lighting is installed...



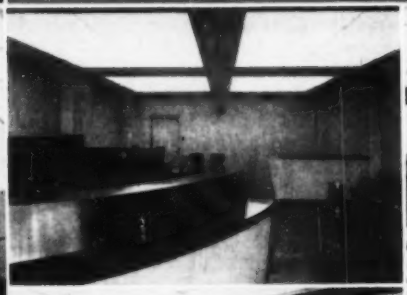
Installations like these the country over vary greatly as to size, pattern, shielding, intensity and periphery. But they all have these things in common: superb quality of illumination and *ease, simplicity and economy of installation.* That's why electrical contractors the country over are finding in Smithcraft Area Illumination a source of excellent new profits and a source of pride and business-building prestige in the installation of today's finest lighting.

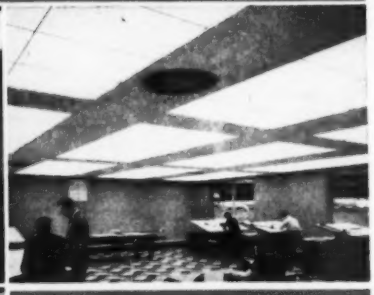


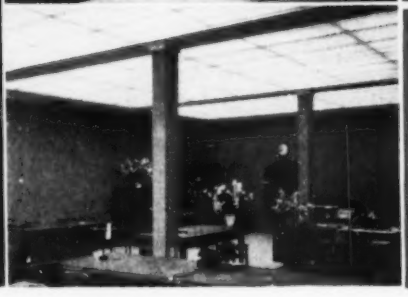
Reading from left to right, starting at top:

The Mennen Company, Morristown, New Jersey
Owens-Corning Fiberglas Corp., Ashton, Rhode Island
Ford Motor Company, Dearborn, Michigan
Melbourne National Bank, Melbourne, Florida
Niagara Mohawk Power Corp., Syracuse, New York
Rawding Electric Company, Beaver Falls, Pennsylvania
Texas Eastern Building, Shreveport, Louisiana
Mount Healthy-Saving and Loan Company, Mt. Healthy, Ohio
Van Huffel Tube Corporation, Warren, Ohio
Florida Power and Light Company, Sanford, Florida

smithcraft **area** *illumination*







...information on Smithcraft Area Illumination

Smithcraft
LIGHTING DIVISION
CHELSEA 50, MASSACHUSETTS

NOVEMBER . . . . at a Glance

THE OUTLOOK—We usually have a good file of facts, related statistics and general information about the industry we work for. Consequently, around this time of year, we hear from certain industry folks whose job it is to forecast trends and set up marketing objectives for the year ahead. These are the months when budgets are drawn and targets established by many of the top manufacturers in the industry.

Few people realize the hair graying responsibility these experts carry. An overestimate may result in idle machines, expensive inventory accumulation and high sales costs. An underestimate can result in lost business, a loss of competitive position, expensive delays for customers and high manufacturing costs. Invariably they are realistic. They have to be.

If we sense correctly what their recommendations are going to be—don't sell 1954 short. All is not necessarily rosy. The electrical construction industry is not immune to storms in the general economic climate. But the indices pertinent to our industry are currently in robust good health. If there are troubles ahead, the symptoms don't show yet.

Department of Commerce "value of new construction" is running 8% over last year. There is a big plus in commercial, modest increases in utility and private residential. The long predicted dip in industrial is actually only a tiny fraction. Farm construction is responding to the decline in farm income. Public housing and institutions are reflecting the administration's economy drive. Per capita expenditures in constant dollars are still well below the boom of the twenties.

It looks like appliance sales will wind up the year with a new record. And kilowatt hour sales are continuing a steady advance.

For the record right now, with the hedge that we might have to adjust some when the fourth quarter picture clears, we think the electrical construction and maintenance industry will have as good or maybe 5% better business in 1954.

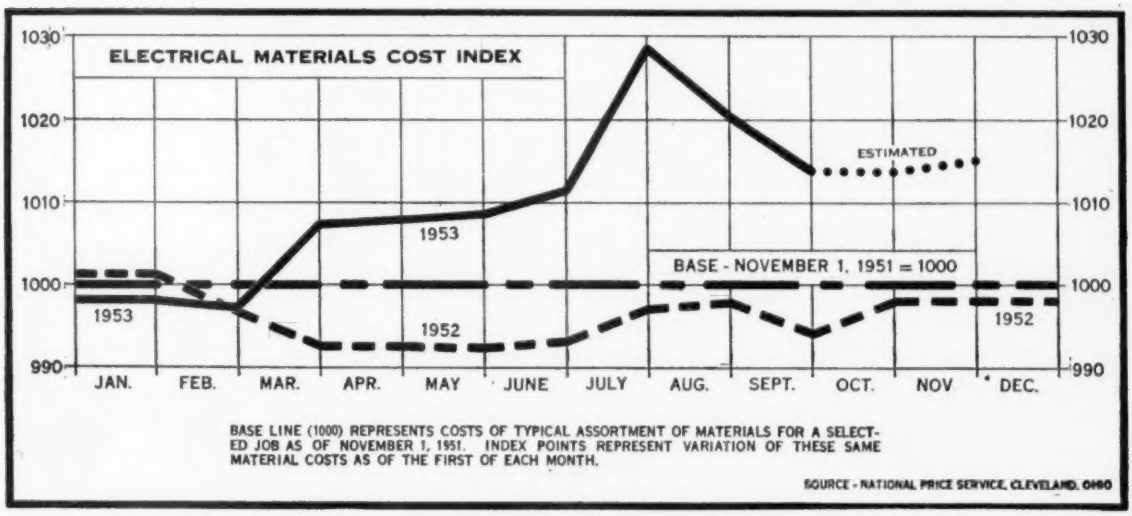
NIGHT SALVAGE AT LIVONIA—For 26 years, Jack A. Frost, Detroit electrical contractor, has operated a temporary lighting equipment rental service as a division of his contracting operation. Portable equipment made his service a "natural" for commercial film producers "on location" and others in the entertainment category. Not once did he have occasion to operate in an emergency capacity. Not until fire made a shambles of General Motors' Livonia, Michigan, plant this summer.

When G. M. decided on round-the-clock salvage schedules to save precious time, Frost was ready to meet the challenge of lighting up night operations. To learn how he installed more than 800 kw. of floodlighting in record time, read ". . . Mobile Emergency Floodlighting . . ." on page 67. The job was an eye-opener to plant management, salvage contractors and even Frost himself.

OVERSIGHT—In the report of the first prize in the miscellaneous classification of the lighting competition last month (page 102) the winner, Fay Foster, is correctly identified with Stoneburner-Verret of Port Arthur, Tex. However, at the time the project was initiated he was connected with the Jack Hyde Electric Shop of that city. While this was stated in Mr. Foster's official entry, it was unintentionally omitted in editing the published report.

NUCLEAR POWER—Government and diplomatic criteria have won out in the long complex contest for the development of nuclear power. Commissioner Murray on October 22 announced that the A.E.C. will build a full scale, 60000 kw or more, generating plant. Westinghouse has the job. It will take three or four years.

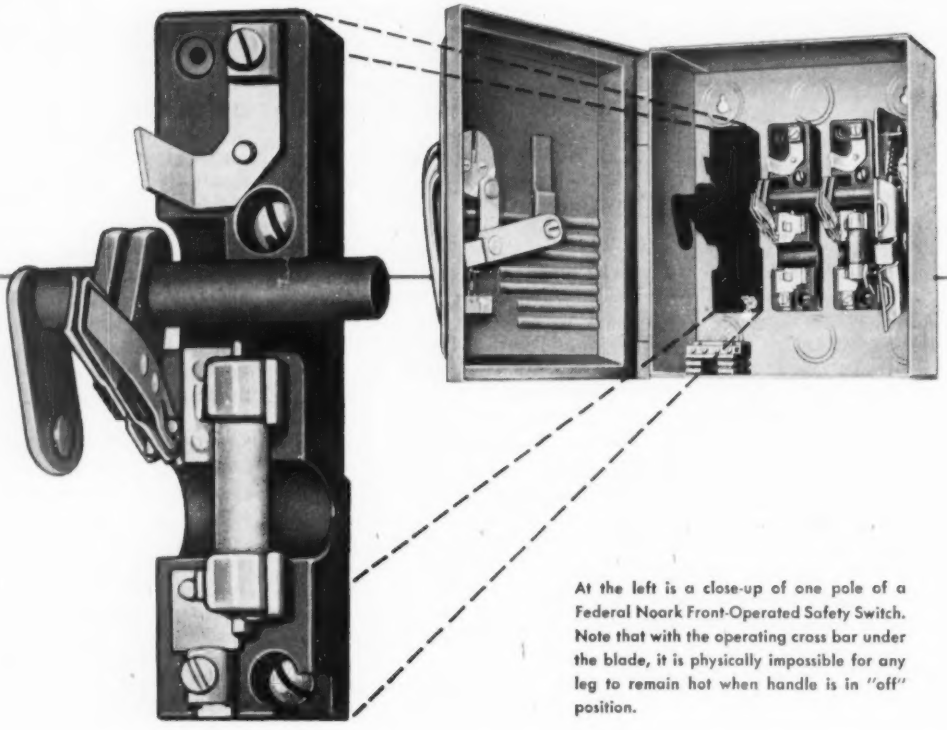
While the Federal Government will sponsor and finance the initial reactor development, Commissioner Murray, in announcing the plan, expressed his conviction that the cost cutting drives, the know-how, skills and competition of private industry were needed and that opportunities for private enterprise and capital would be forthcoming.



BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

FOR SAFETY'S SAKE...OPERATING CROSS BAR UNDER THE VISIBLE BLADES



At the left is a close-up of one pole of a Federal Noark Front-Operated Safety Switch. Note that with the operating cross bar under the blade, it is physically impossible for any leg to remain hot when handle is in "off" position.

FEDERAL NOARK has gone the limit to assure you the safest industrial switch ever designed. Federal Front-Operated, for instance, is the *only* visible-blade switch with the operating cross bar *beneath* the switch blades where it unfailingly protects the operator...forces the blades open...guarantees current break.

And for complete, all-around efficiency, these switches have a man-size front-operated handle that positively snaps the switch to "On" and "Off"...a double fibre hook to pull the blades in...a patented high pressure fuse holder that holds the fuse like a vise and that has a minimum number of joints, assuring coolest operation and longest service life.

In addition, special design features make these industrial switches the easiest to install and maintain. Order Federal Noark Front-Operated Industrial Switches from your distributor for the best in modern design and the biggest dollar value on the market today.

Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK®

ELECTRICAL CONSTRUCTION AND MAINTENANCE

53rd Year—NOVEMBER • 1953

No Place to Hide

TIME WAS WHEN this was a comfortably secluded business. Reasonable decorum, judgment and reputation among the small circle of the building fraternity would suffice. The general public knew little, and probably cared less, about the qualifications of an electrical contractor.

MODERN LIGHTING has done much to change all that. The lighting job is the most conspicuous feature of a building. And the public today is not only interested in lighting and aware of its progress, but laymen in increasing numbers are capable of excellent critical judgment about the quality of lighting results.

THE ELECTRICAL CONTRACTOR who installs lighting can't hide his prowess, good or bad. His art and skill are exposed to daily view and criticism before a knowing public. And his reputation is irrevocably committed to his conspicuous deeds.

THE INDUSTRY UNDERSTANDS and sometimes sympathizes with the contractor who carries out somebody's inadequate and substandard specifications. But the public is neither aware of the complexities of industry relations nor charitable toward indifferent performance. Waivers of responsibility or the best of alibis are worthless outside the family.

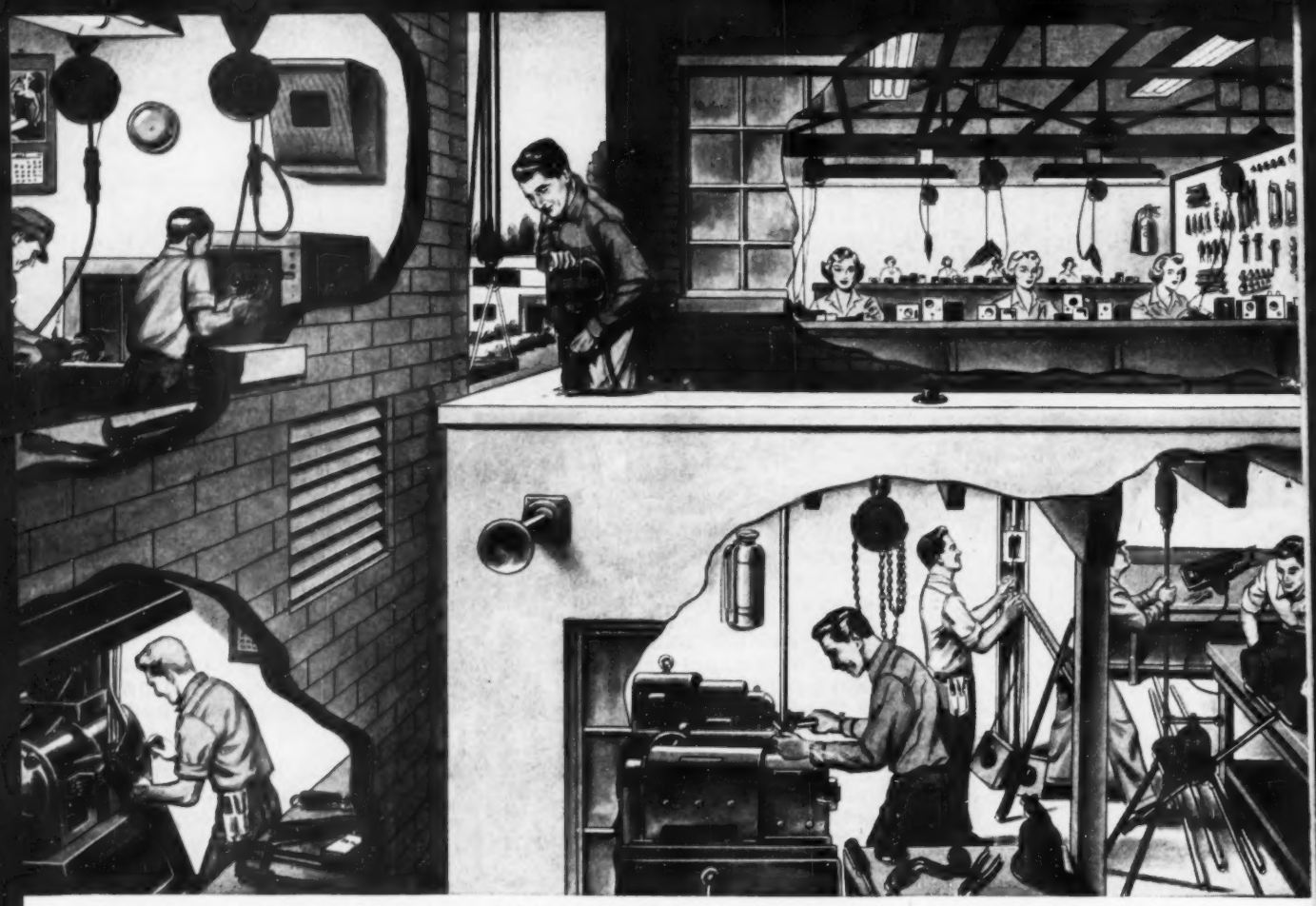
A FEW UNHAPPY CONTRACTORS are learning these facts the hard way. They take jobs without care for standards so long as the margin is adequate. They sweeten up the job a little by substituting a line of Tinbender Specials. They compromise willingly on design when the owner wants to trim the cost. And, incredibly, some will even accept installation of equipment furnished by "others".

LIGHTING JOBS are abundant. But competition can be rough. Good layout with high quality equipment is easy to attack through design compromise and price cutting tactics. Dirty work within discrete industry walls may seem safe enough. But an electrical contractor is party to such practices at his own grave personal peril.

LIGHTING IS BIG BUSINESS and growing bigger. The individual contractor builds his own public record. The testimony is obvious and objective. The smart money is on the contractor with the reputation for consistently bold performance to back his play.

SUBSTANDARD INSTALLATIONS can't be hidden. The contractor who will not police his own lighting standards is stuck with those he accepts. But the contractor who is regularly identified with top quality jobs can write his own ticket.

Wm. T. Stuart



GRAYBAR CAN SUPPLY VIRTUALLY ANY TOOL needed for plant production line, construction, or maintenance work. Just call your local Graybar Representative or nearby Graybar office or warehouse. They'll provide prompt, accurate price and specification data on tools as well as any of your other electrical needs.

The right tools get the job done faster

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FIFTY-FOOT TOWER in foreground mounts 10,000-watt floodlights (bright spot) powered by portable generator on truck at base.

An Electrical Contractor's

MOBILE EMERGENCY FLOODLIGHTING

service gave General Motors Corp. a head start on machine and tool removal at its burned-out Livonia plant. System supplied by Jack A. Frost, Detroit, permitted round-the-clock salvage operation.

WITHIN six hours after the first alarm brought fire-fighting equipment to the General Motors transmission plant in Livonia, Michigan, this summer, temporary lighting equipment was set up around the flaming structure to allow firemen to work on into the night. When the fifty-million-dollar holocaust was over, and nothing but a twisted, collapsed structure remained, management started the race against time to renew production in another area at the earliest possible moment. First step was the immediate removal and shipment of expensive machines and tools to manufacturers for salvaging, meaning round-the-clock operations involving nearly 3,000 workers on two 12-hour shifts for 14 days.

With the salvage contractors came Jack A. Frost, Detroit electrical contractor, with more floodlights, more portable generator units and 40-ft. and 50-ft. floodlight towers. Frost, who has been conducting a temporary lighting equipment rental service for 26 years, had plenty of equipment on hand. But it was not enough. Overnight, he had one large generator

TEMPORARY FLOODLIGHTS cast eerie glow over fire-consumed G.M. plant at Livonia, Michigan; help crane operators continue round-the-clock salvage work.

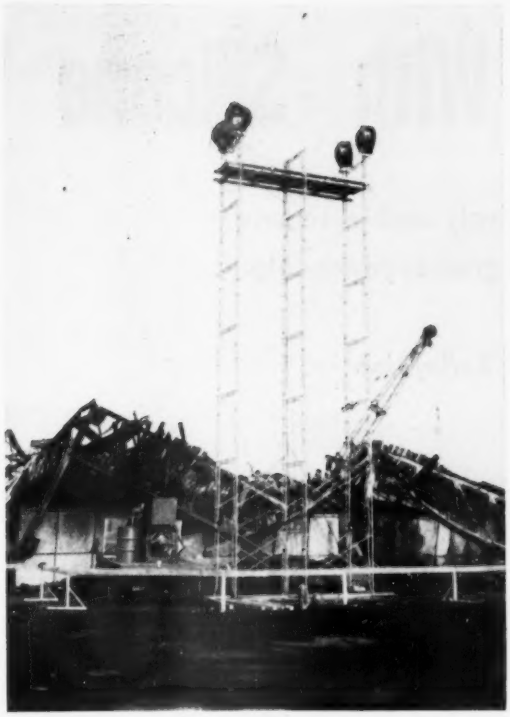
flown in from California; had another trucked down from Minneapolis.

Night salvage crews worked under illumination provided by 25 portable generator plants ranging in size from 150-amp to 600-amp, single-phase; and 25 to 35 kva, 3-phase, 4-wire. A total of 200 flood and spot lights of various wattages were served by some 12,500 feet of cable ranging in size from No. 3/0 to No. 12, 2-wire super service cable plus an array of plugging boxes and connection spiders spotted around the area.

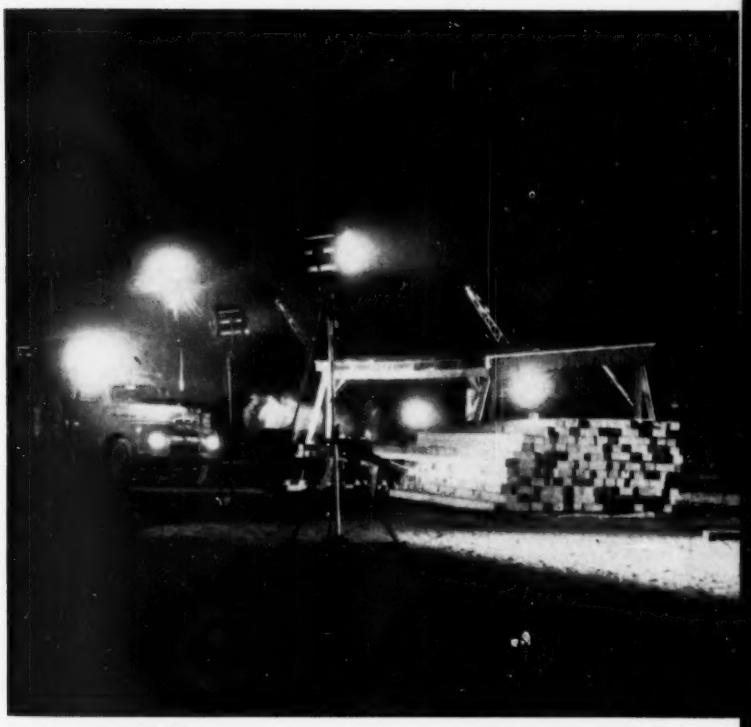
For over-all area lighting, fifty 10,000 watt floodlights were used. They were mounted in groups of three and four (or more where necessary) on 40-ft. and 50-ft. towers built up of standard sectionalized scaffolding units. While crane booms swayed eerily in the floodlit gloom, salvage crews worked feverishly under damaged roof sections to remove expensive machines and production tools. Lighting in these areas was provided by some 76 flood units of 2,000-watt and 5,000-watt size mounted on adjustable tripod dollies. In addition, more than seventy 1,500-watt units were set up where needed throughout the area.

Approximately 820 kilowatts of temporary lighting were required to facilitate night operations. Without it, the salvage work could not have been completed in the record-breaking two-week period and the ultimate cost of an extended down-time and production loss could have been considerably greater than now estimated. It was fortunate for all concerned that a temporary lighting service organization was located in the immediate area and that it had available ample power and lighting equipment to make an installation within hours after the catastrophe occurred.

To the Frost organization, this experience was as unique as the service it had to offer G.M. management and the salvage contractors. This was the first time the equipment and service was ever used in an emergency manner. Usually rental service of this type is confined primarily to the entertainment category—film producers frequently use it when shooting "on location". To Frost service men, who installed and maintained the emergency lighting for the fourteen nights, this, too, was a unique experience. Some of them put in 37-hour stretches without sleep.

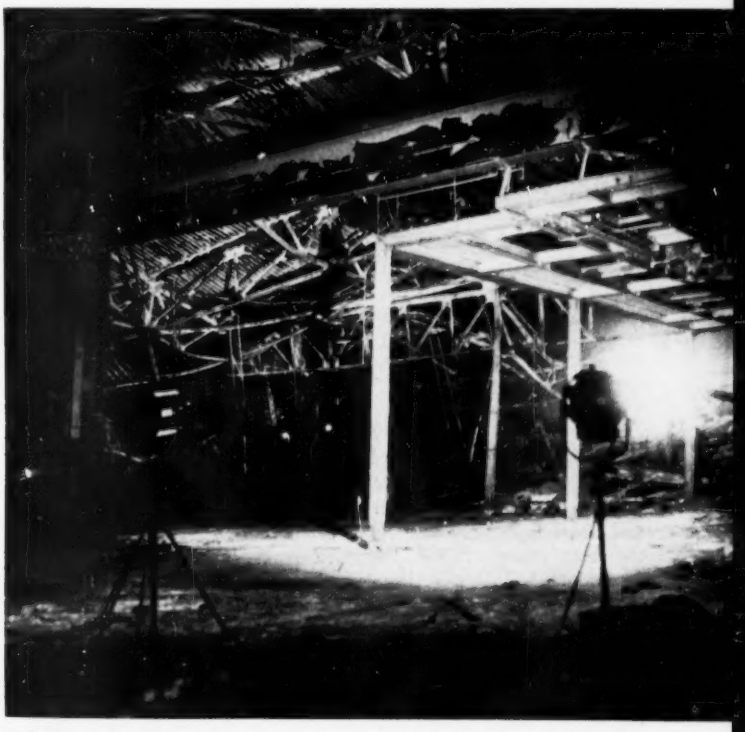


SECTIONALIZED SCAFFOLDING forms 50-foot tower for four 10,000-watt floodlights; can be assembled and disassembled in short time. Note collapsed building structure in background.



NIGHT OPERATIONS at rail siding continue under group of spot lights on adjustable tripod dollies. In center is cutting shelter where wood skids and blocks are cut to appropriate sizes for bracing machinery loaded on flat cars.

TRUCK-MOUNTED GENERATOR is one of 25 mobile units used to power the 820-kilowatt emergency floodlighting installation.



TRIPOD DOLLIES bring 5,000-watt and 2,000-watt floodlights inside damaged building areas to facilitate night salvage of expensive machines, and production tools.

Uprating Horsepower With Silicone

Silicone electrical insulation is effectively and extensively used to "uprate" standard size motors to greater power output.

By G. E. McIntyre and E. P. Earleywine
Dow Corning Corporation

WHEN considering the possibility of taking additional horsepower from a given motor there are usually three factors to be considered:

1. Is the motor capable of producing the required horsepower?
2. Is the operating temperature within the safe range of the insulation used?
3. What effects will this re-rating have on the operating characteristics of the motor such as power factor, efficiency, pull out torque, starting torque and rpm?

Motor Design

The answer to the first question is dependent on the mechanical design of the motor. If the design is such that the motor is not readily capable of producing more horsepower, uprating is generally impractical. If the design does permit greater output, the heat resistance of the insulation must then be adequate to withstand high operating temperatures.

Insulation

It is a recognized fact that, the greater the load on a given motor, the hotter it runs. Consider the reason why and the results.

No motor operates 100% efficiently. Some of the power put into the machine as electrical energy must be dissipated in the form of heat. If we double the electrical energy input, and the efficiency remains the same, the heat energy to be dissipated is also doubled. In dissipating more heat the motor housing reaches higher temperatures which means that the windings have also reached higher operating temperatures. Any increase in temperature of the windings makes the heat stability of the insulation of greater importance to the serviceable life of the motor. And that is the reason that proper choice of insulation is an important factor in "uprating" motors.

Class B insulation offers some advantage in that it will withstand higher operating temperatures than Class A insulation. But the permissible hottest spot temperature for a Class B machine is only 25 centigrade degrees higher than that of a Class A machine. The accepted hottest spot temperature for Class B insulation is 130°C; for Class A insulation, 105°C.

The full temperature possibilities of glass, mica, and asbestos in existing Class B insulation are not realized due to the limitations of the synthetic or natural organic varnishes which are used. The best organic varnishes have a relatively short life at temperatures of 150°C and therefore the varnish itself is primarily responsible for the 130°C limit generally used.

Silicone (Class H) insulation will permit continuous motor operation at hottest spot temperatures of at least 200°C which means almost three times the temperature rise allowed for Class A insulated machines. Such an increase in temperature rating should allow a considerable increase in motor rating. Actually, a minimum of seven years insulation life has been determined at a total hot spot operating temperature of 225°C on motors wound with Class H, silicone, electrical insulation.

Effect on Motor Characteristics

Let us now look at the results of dynamometer testing on three motors after rewinding with silicone, Class H, insulation. Selected for this test were two 225 frames of different manufacture and one 284 frame. These motors were of modern construction, totally-enclosed fan-cooled, and wound for a synchronous speed of 1800 rpm. With a Class A insulated winding these motors are nominally rated at 3 horsepower and 7½ horsepower respectively with a 55°C temperature rise.

In Figs. I, II, and III are shown average winding temperature rise, power factor, and efficiency plotted against motor output in horsepower for the three different motors.

Winding temperature rise, as shown in these curves, was determined by plotting a resistance cooling curve. From past experience in our own test work, we assume that hottest spot rise will be 10°C greater than average rise on these TEFC motors. If we use 200°C total hot spot as a temperature limit for these Class H insulated motors, we find that we could increase the original rating of the 225 frame motors by 100% or more and the 284 frame by 87%. These points are indicated by a temperature rise of 150°C on the curves. The present AIEE hot spot temperature limit of 180°C for Class H insulation would reduce these percentages slightly. However, this 180°C limitation is a conservative rating. The United States Navy Department uses a design figure of 200°C hottest spot temperature for Class H insulated motors.

Keeping in mind that the test units are delivering at least 87% more horsepower than nameplate rating, let us consider the effect this has had on motor operating characteristics.

Efficiency of these three motors is between 76% and 79% which is satisfactory for TEFC motors of these frame sizes. Actually, an efficiency of about 80% would be considered satisfactory for these motors with Class A insulation when operating at 55°C rise. Power factor on these motors runs between 85% and 90% which again would be considered satisfactory.

Insulation

Table I

CLASS H INSULATED MOTOR — 225 FRAME TEFC — #1

Lb. Ft. Torque	RPM	HP out	Efficiency %	P.F. %	Average Temp. Rise °C.
0	1795	0	0	10.3	70
3.0	1790	1.02	49.5	29.7	72
9.0	1770	3.03	72.1	54.5	78
15.1	1755	5.18	76.7	73.4	120
20.0	1738	6.62	76.6	85.5	159
23.0	1730	7.58	76.1	86.6	253
36.5		(Pull-out Torque)			

From the Tables I, II, and III, which correspond to the graphs of the same numbers, it can be seen that these motors also have a pull-out torque value of at least twice the full load torque when we consider full load to be that which causes an average winding temperature rise of 150°C. It is normally expected that in a standard squirrel cage motor the pull-out torque will be at least twice the full load torque. So here again, these motors which have been uprated with Class H insulation satisfactorily fulfill minimum standard motor characteristics. We also notice from these tables that motor speed is between 1700 and 1746 rpm on these units when operating at maximum continuous load. These same motors with Class A insulation are normally rated at 1740 rpm at nameplate load.

It is quite apparent that we would not be able to obtain the motor operating characteristics as shown for these motors without a change in the magnetic or electrical circuit in the motors. A change in the magnetic iron for a re-rating job would be very difficult if not impossible and would certainly be impractical. Fortunately, this is not necessary nor was such the case on the motors in question. The motor windings were changed however.

As a specific example, the motor whose characteristics are shown in Fig. I normally carries 25 turns of No. 17 heavy Formvar magnet wire per coil. When the unit was rewound with Class H insulation 20 turns of No. 16 double glass served silicone bonded magnet wire per coil were used. Thus, wire size was increased one full size and the number of turns was cut down by 20%. Similar changes were made in the motor windings of the other two units whose characteristics appear in Figs. II and III. These would certainly be considered major changes in the motor windings and must have a pronounced effect on the motor operating characteristics.

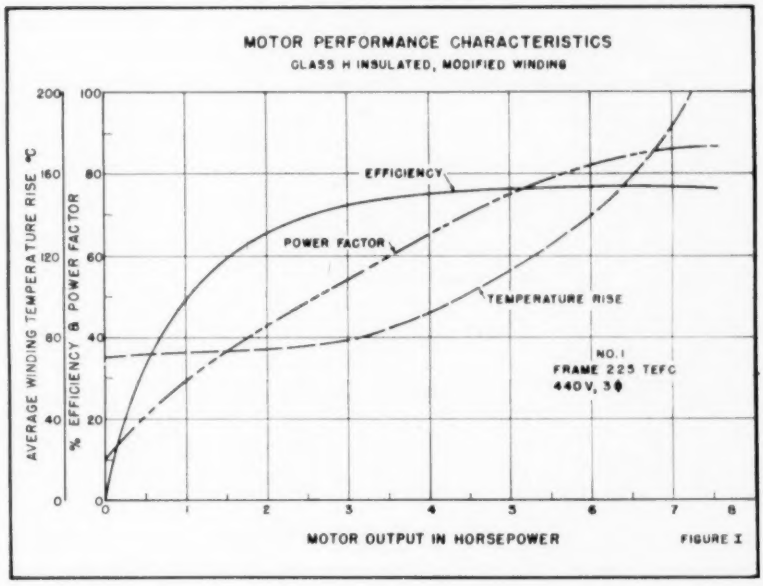


FIGURE I

It is undoubtedly these winding changes which allow the efficiency and power factor to hold up with loadings from 87% to 100% beyond nameplate rating. Such a winding change would also tend to increase pull-out torque in that the resistance of the stator winding is decreased. On the other hand, this change in winding has sharply increased the no-load running current on these Class H insulated motors which is a drawback only when the motor is required to run at light loads for extended periods of time. Measured no-load running current on these motors was from two to three times the no-load current on the same motors with the original windings.

In Figs. IV and V are presented operating characteristics of two of these motors with the original Class A insulated winding. Fig. IV may be compared with Fig. II to see what effect the winding change has had on the 225 frame motor. Likewise, Fig. V may be compared with Fig. III for the 284 frame motor. It can be seen that a winding change becomes important when uprating a motor if maximum horsepower output is desired and if increased starting and no-load running current is not objectionable.

It would be very difficult to make any hard and fast rules on possible uprating of electric motors with high temperature insulation. There are many variables which have a bearing on the ultimate horsepower which can be taken from any given motor. The type of motor, size of frame, winding, and even ambient operating temperature have an effect on the percentage

Table II

CLASS H INSULATED MOTOR — 225 FRAME TEFC — #2

Lb. Ft. Torque	RPM	HP out	Efficiency %	P.F. %	Average Temp. Rise °C.
0	1800	0	0	15.4	52
3	1795	1.03	55.5	39.9	53
6	1775	2.03	68.8	59.8	55
9	1760	3.02	74.2	72.2	63
12	1750	4.00	75.4	80.4	76
15	1730	4.95	79.5	83.7	99
18	1710	5.87	76.8	89.2	137
20	1680	6.40	73.9	90.4	176
21.25	1650	6.68	71.6	91.4	212
37.75		(Pull-out torque)			

Table III

CLASS H INSULATED MOTOR — 284 FRAME TEFC — #3

Lb. Ft. Torque	RPM	HP out	Efficiency, %	P.F. %	Average Temp. Rise °C.
0	1800	0	0	15	50
6	1795	2.05	55.8	37.6	50
12	1780	4.07	69.3	54.7	60
18	1780	6.11	76.8	67.7	66
24	1770	8.09	79.2	75.8	75
30	1762	10.07	83.0	77.8	93
36	1745	11.97	80.3	84.5	112
40.7	1735	13.47	79.7	87.8	136
44	1715	14.37	77.8	89.5	158
46	1705	15.11	76.4	90.8	188
90	(Pull-out torque)				

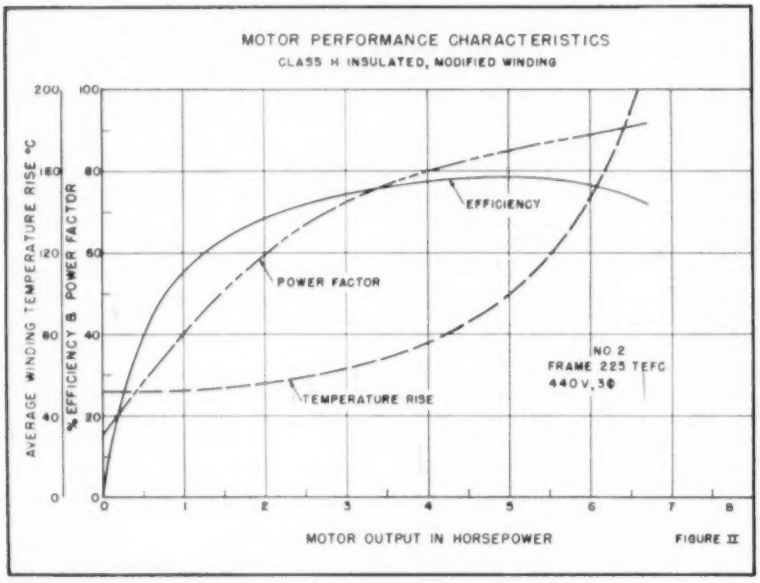


FIGURE II

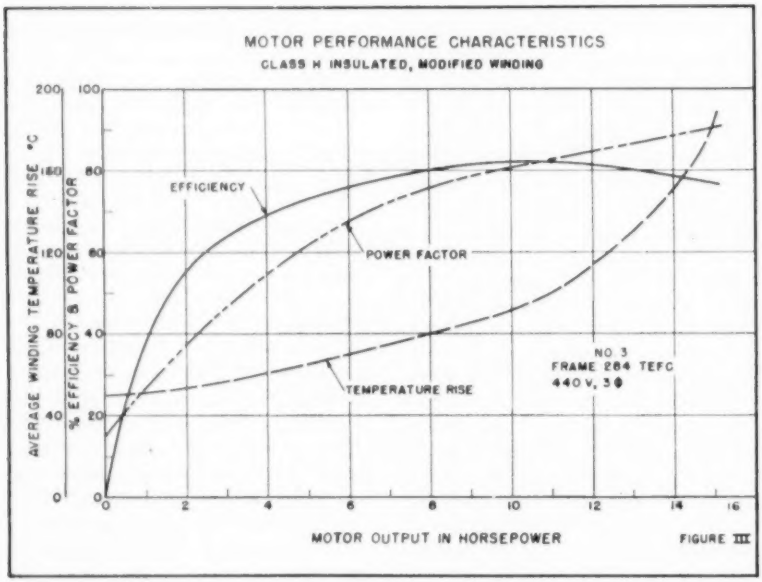


FIGURE III

horsepower increase which can be expected from the use of Class H insulation. Generally all standard continuous rated motors will safely handle the turns reduction as suggested here. However, on some special motors such as high torque, intermittent duty, and multi-speed, considerable caution should be used in making any turns reduction in the windings since magnetizing current will already be a large proportion of full load current.

The test results as presented here, do, however, give a positive indication of what may be expected in the way of uprating motors. This data added to the wealth of information from actual field applications on Class H insulated motors operating at high overloads allows us to state:

The use of Class H insulation to replace Class A materials on motor windings will generally allow a 50% to 75% increase in horsepower rating without exceeding temperature limits for the silicone, Class H materials. A 50% increase in rating could normally be expected without changing the motor winding and a 75% increase would be conservative when changing the motor winding, at least on the smaller frame size motors.

It is recommended that silicone grease be used in the ball bearings of motors which are uprated with silicone insulation. Although bearing temperatures do not increase as rapidly as winding temperatures under increasing load, it is quite probable the bearing temperatures will be higher than organic lubricants will withstand with the motor winding operating in the 200°C range.

Case Histories

These cases are typical of what can be done to increase the power output of equipment originally built with Class A insulation by rewinding

Table IV

CLASS A INSULATED MOTOR — 225 FRAME TEFC — #2

Lb. Ft. Torque	RPM	HP out	Efficiency %	P.F. %	Average Temp. Rise °C.
0	1800	0	0	17.8	22
3	1787	1.02	64.5	67.6	23
6	1768	2.02	73.9	88.7	32
9	1750	3.0	77.7	90.2	35
12	1712	3.91	75.3	88.3	79
15	1665	4.76	72.7	84.7	124
28.5	(Pull-out torque)				

Table V

CLASS A INSULATED MOTOR — 284 FRAME TEFC — #3

Lb. Ft. Torque	RPM	HP out	Efficiency %	P.F. %	Average Temp. Rise °C.
0	1800	0	0	18	18
6	1790	2.04	72	67.3	24
12	1770	4.05	80.7	84.5	35
18	1765	6.04	82.2	90.8	36
24	1750	8.0	82.3	94.2	57
30	1715	9.8	78.7	92.9	94
35	1680	11.2	76.0	92.0	152
56.5	(Pull-out torque)				

with Class H silicone insulation. And to give credit where credit is due, in each case it was the farsighted electric motor repair shop manager who solved a difficult problem for his customer by the most economical means, a Class H insulated winding.

A large chemical manufacturer had 27 motors operating high pressure pumps. These motors were rated at 50 and 60 horsepower; that is, motors of both sizes are doing this pumping job. Increased output from these pumps was desired but could only be obtained by operating the pumps at loads higher than possible with the Class A motors. The motors would have to deliver at least 75 horsepower continuously with frequent peak loads of 86 horsepower. The first of these Class A insulated motors which were rewound with Class H insulation have been operating satisfactorily for four years now. All 27 motors are now insulated with Class H insulation and all are delivering 50% more power than their original rating.

Class H windings were used in the old motors rather than installing new Class A insulated motors of higher rating because of the considerable money saving possible by such a conversion. Company engineers have calculated that savings of approximately $38,000 were effected by rewinding these motors with Class H instead of buying and installing new motors of higher rating.

A second case concerns a diesel-driven 200 kw, 450 volt, 1200 rpm ac generator. A manufacturer of diesel-electric power units had orders for several 300 kw, 2400 volt, portable power units. Since the equipment was to be of portable type a minimum weight and size was desired. These Class A insulated 200 kw units were available and by converting these units

(Continued on page 274)

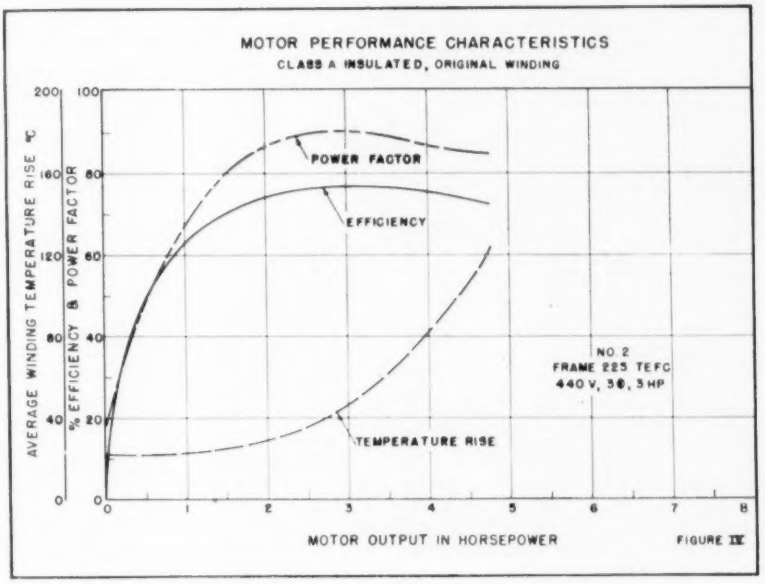


FIGURE IV

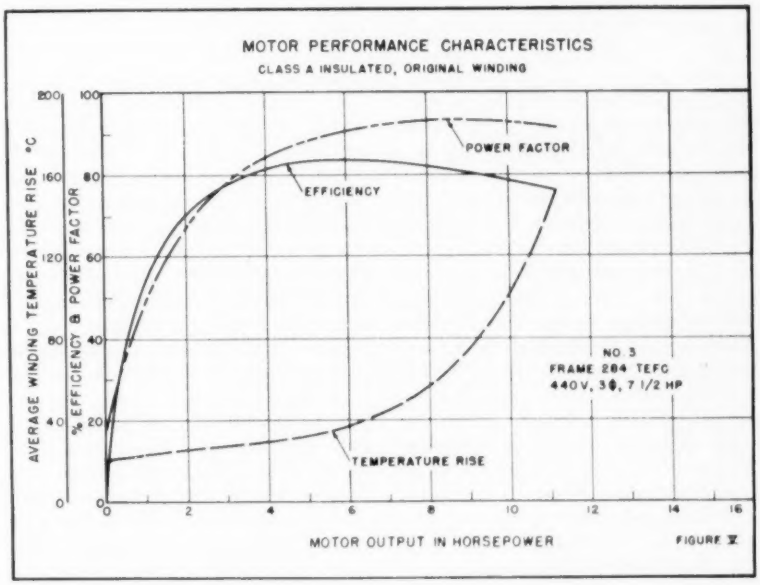
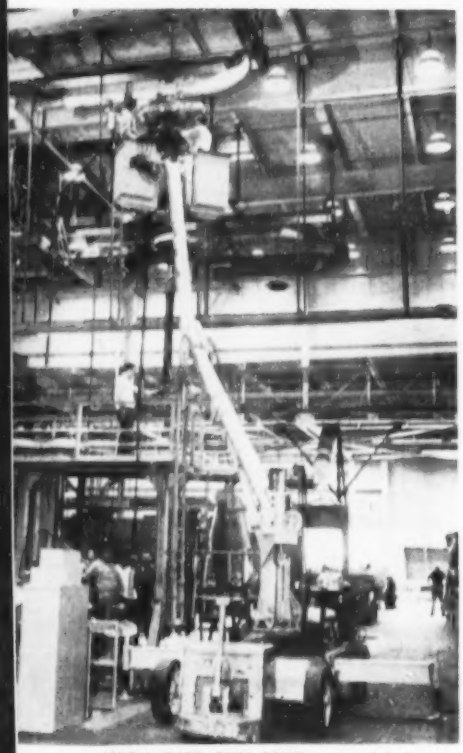


FIGURE V

Propeller production backed by . . .

FLEXIBLE DISTRIBUTION



HIGH RISE SKY LIFT is useful for installation, inspection and maintenance of equipment located in high-bays. Baskets may be moved vertically or in arcs.

Dual electrical feeder systems, flexible bus-duct networks, multi-voltage power and extensive mechanization are features of this modern production and research center wired by Lord Electric of Boston and Baldwin-Stewart of Hartford.

By Hugh P. Scott

HAMILTON Standard's new production center at Bradley Field, Windsor Locks, Connecticut, is a modern, cleanly-designed, 14-acre structure, representative of the highest standards in construction and the latest concepts in engineering. It is also a fine example of efficient load-center electrical distribution, high-voltage primary wiring, remote-control relay switching, thorough grounding and all-round productive electrification.

Served by two incoming lines from separate utility networks at 28.8-kv, the main substation consists essentially of two 7500-kva 28.8/13.8-kv delta-wye power transformers, a high-voltage connecting bus equipped with a normally-open gang-operated disconnect, and a segmented low-voltage 13.8-kw bus structure tied together through 3-pole breakers. Feeders between main transformers and the 13.8-kv bus, also between these bus segments and basement-based load-center substations strategically located throughout the plant, are 3/c Type H Neoprene-jacketed cables. Feeders are run underground, except in transformer vaults where they are carried overhead in racks suspended from floor slabs and structural beams.

In all, there are ten substations that, collectively, include eight 1000- and six 750-kva 240-volt transformers, nine 300-kva 120/208-v 3-phase 4-wire lighting transformers, one 1000-kva 480-volt transformer, a 500-kw delta-star rectification unit for 230-volt direct current, one 1200- and a 750-kva special 13800/1955/2300-volt transformer to serve high-frequency m-g sets.

Most of the 240- and 120/208-volt transformers are paired to form double-ended unit subs, with bus segments linked through 3-pole breakers. In all cases, the several transformers at each substation are served from the main switchboard through separate feeders although, through the use of multiple potheads, these same feeders may serve as many as three, four or five transformers, each located at a *different* substation. Wherever double-ended 240-v subs serve plug-in bus-duct systems, they are equipped with ground detectors in the interest of faster trouble-shooting detection and minimized disruption of service.

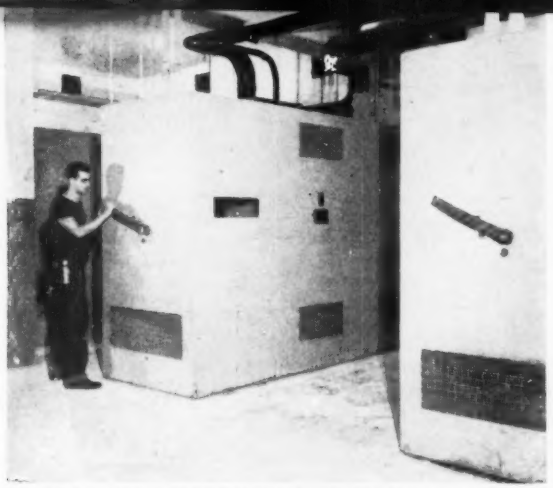
Extensive Use of Bus-duct

Bus-duct is used widely throughout the plant, providing a distribution system which is rugged, flexible and—if production layouts are ever altered—completely salvageable. Duct runs include heavy-duty low-reactance Flex-A-Power feeders, FVK plug-in runs for 240- and 440-v ac, and LTG trolley tap-offs for 230-volt dc test equipment.

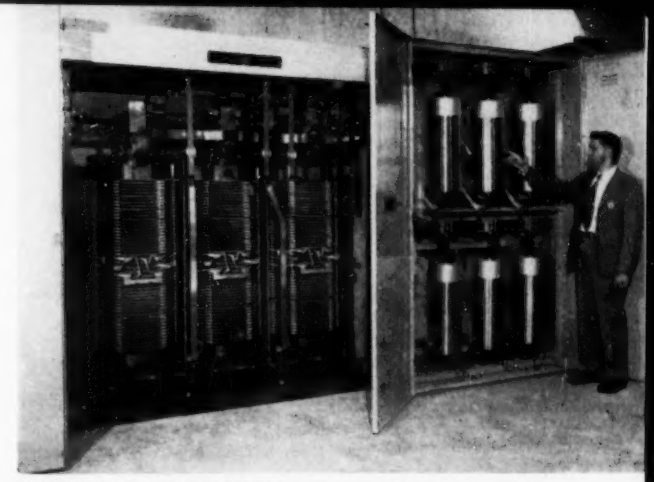
All substations are basement-based below the production areas they serve, and all substation equipment is thoroughly grounded to ¼-by-2-inch copper buses that encircle each vault. These buses, in turn, are connected at closely-spaced intervals to copperweld ground rods through brazed bus clamps, and the grounding bus assemblies are likewise brazed to all structural building columns in their immediate vicinities.

Utilization voltages are carried from basement-based substations to overhead plug-in bus-duct runs which are located over production areas above the lower chords of roof trusses. Feeders for these connections include low-reactance ventilated bus as well as standard cable-conduit runs, and risers are run upwards adjacent to structural columns to facilitate mounting details.

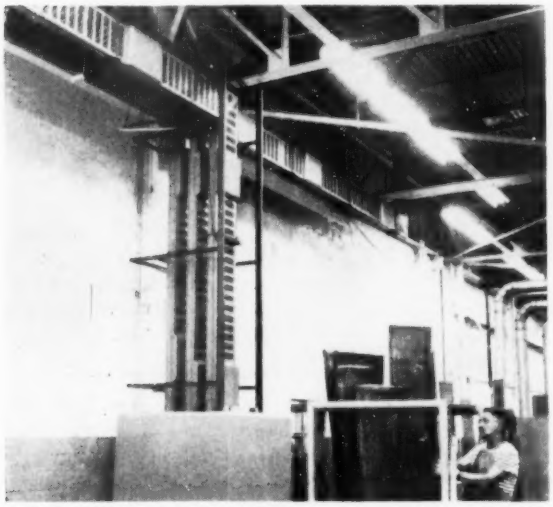
Power factor in the plant is kept in the upper 90's through the extensive use of 120-kvar capacitors which are also mounted to upper truss members. Contactors for the relay switching of capacitor banks are located in close proximity, while connections between



TYPICAL BASEMENT-BASED SUBSTATION includes two pair of 13800/240-volt transformers with bus ties, breakers and low-reactance feeders to production areas, plus additional units (not shown) for other ac or dc services.



RECTIFYING TRANSFORMER connected delta-star, together with rectifier bank, provides 230-volt dc for test purposes and control. Bus structure is fed through 2000-amp breaker, secondary feeders through 400-, 600- and 800-amp breakers.



HEAVY DUTY FLEX-A-POWER feeders carry 240- and 440-v power from basement-based substations to plug-in bus-duct runs that are mounted above truss levels to distribute current to all sections of the manufacturing areas.

GENERAL ILLUMINATION is provided by 2-lamp industrial fluorescent fixtures mounted to continuous wiring channels set on 13-foot centers. Gaps between fixtures allow for future additions.

capacitor units and 400-amp bus-duct runs are effected through standard air-breaker bus plugs.

Lighting Increase Provided For

Throughout the production area, lighting is provided by 2-lamp 5-foot industrial fluorescent units mounted on continuous wiring channels located on 13-foot centers. Lighting units are mounted in groups of three, end-to-end, with a gap for one standard unit between each group, thus providing for the later addition of extra units without disturbing the existing installation, should the need for additional light develop.

This modern plant reveals numerous signs of thoughtful design and judicious maintenance approaches. For example, the face of the main switchboard carries a mimic feeder diagram, showing the relation of each breaker to the system as a whole. Red bullseye indicator lamps show what switches are in service, green indicates switches not in use, and white shows which switches are set for automatic trip.

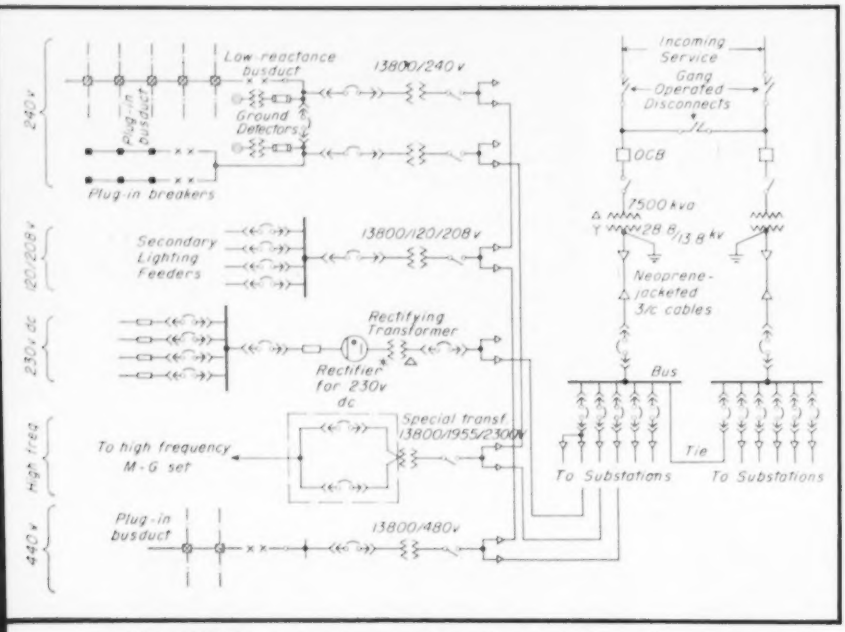
At the enclosed shipping docks, overhead unit heaters are synchronized with roll-up doors and are thermostatically controlled so that tempered air can combat the inrush of cold blasts during winter trucking operations. At these same shipping docks, hydraulically-operated tail-board platforms can be adjusted to exact heights by floor-recessed foot-pedals.

At the cadmium and zinc plating tanks, busbars are connected by thermite welds rather than by standard clamps in a successful endeavor to minimize corrosion.

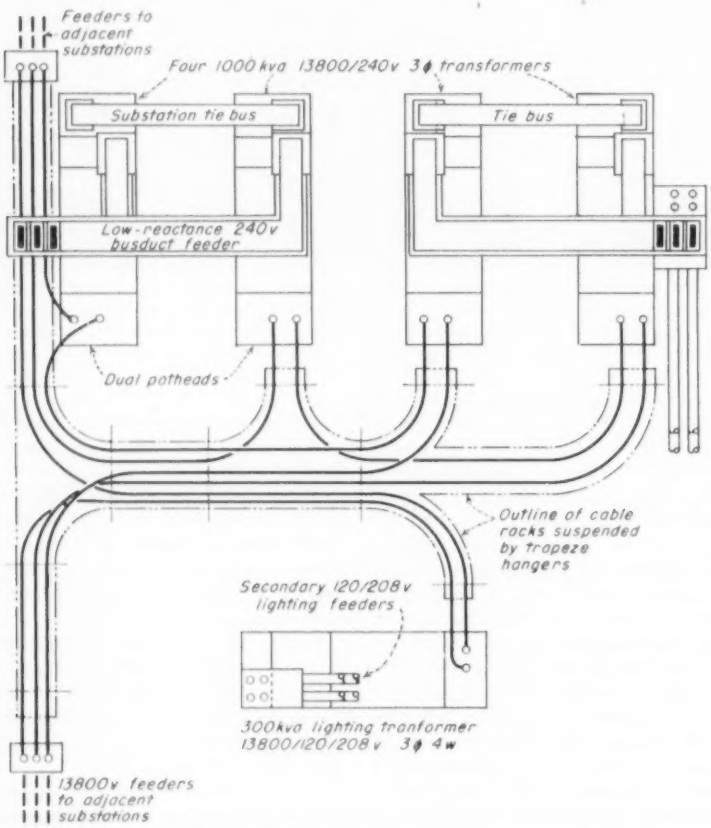
Electric heating is also extensive, with brazing presses fitted with Calrod units, induction heating used for hardening processes and infra-red lamps utilized for several other production routines.

Cable racks show to advantage the versatile features of Unistrut members, while rod and strap sway braces are installed frequently to insure perfect alignment of lighting troughs and bus-duct runs.

Flexible drop cords from overhead plug-in bus-ducts to production machines are kept neatly taut by means of cable grips placed at the lower ends, holding the cables *down*, and spring



DUAL FEEDERS, dual potheads and modified banked-secondary wiring provides flexible distribution system with ample provision for by-passing faults should they occur. Use of low-reactance feeders, plug-in and trolley-duct, plus rectifiers, m-g sets to furnish hi-cycle current, and several ac voltages combine to form electric system with high degree of versatility.


Feeders to adjacent substations
Four 1000 kva 13800/240 v 3ϕ transformers
Substation tie bus
Tie bus
Low-reactance 240 v busduct feeder
Dual potheads
Outline of cable racks suspended by trapeze hangers
Secondary 120/208 v lighting feeders
300 kva lighting tranformer 13800/120/208 v 3ϕ 4w
13800 v feeders to adjacent substations

SUSPENDED CABLE RACKS support primary 13.8-kv cables in transformer vaults. Secondary power is distributed through the plant via standard cable-conduit and bus-duct.

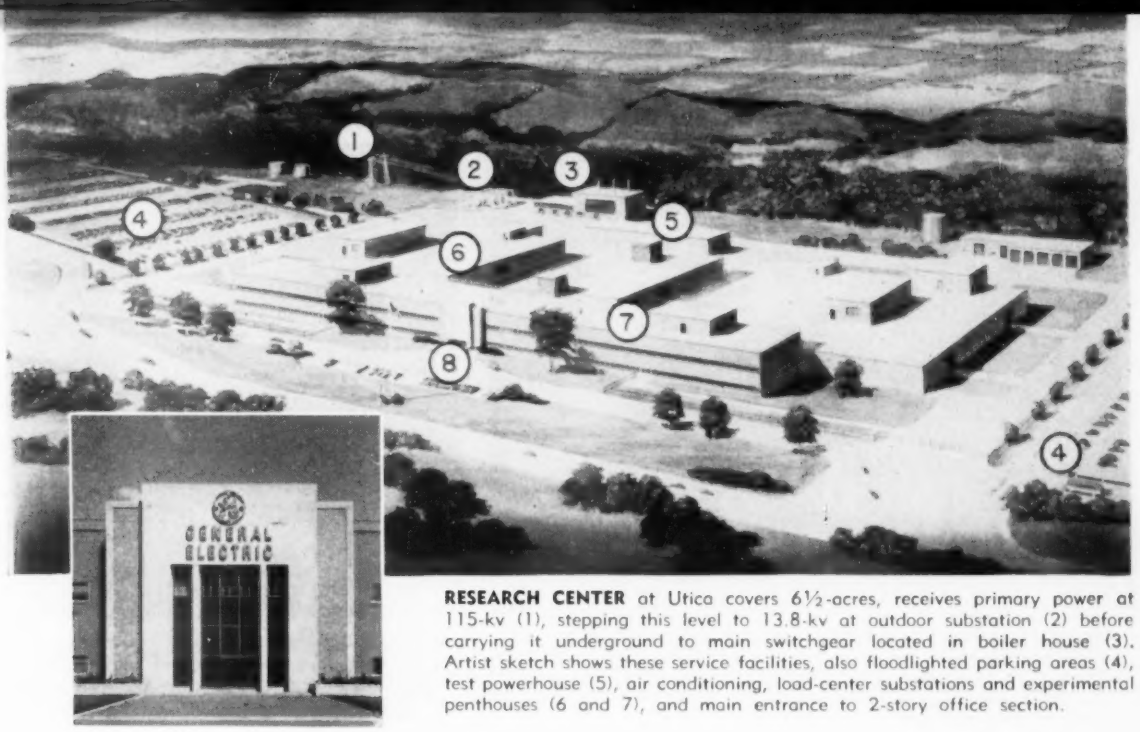
cable cradles that hold the upper ends snugly up.

Not only is electrical equipment of high quality, installed with a high order of installation workmanship, but it is kept in peak operating condition through a maintenance program that includes modern tools, accurate records, scheduled inspections, pre-planned routines and trained personnel.

Illustrative of the unusually modern maintenance equipment is a Sky-Lift electrically-operated truck which supports two men in waist-high working cages. These cages can be jack-knifed upwards for 40 feet or rotated in a wide arc, thereby permitting workers to inspect and service equipment over a large area while the truck remains at one fixed position. Raising, lowering and rotating the supporting booms is activated from lever controls attached to the outside of one of the working cages, power for boom movement being provided through gear-motors, chain drives and hydraulic pistons. Stability is furthered at floor level by means of hinged I-beam wings which may be extended to the sides of the truck and supported by heavy-duty jacks. When it is desired to move the battery-powered truck from one location to another, wings and booms may be retracted so that the then-compact machine can easily move through factory aisles and beneath low-hung lighting fixtures.

Coordinated Moving Program

When Hamilton-Standard recently moved into this new plant from their former outgrown quarters at East Hartford, it was vitally important to national defense and civilian commercial progress that delivery of airplane propellers remain continuous. This posed a gargantuan problem, since over 5,200 pieces of production and office equipment had to be moved. That it was completed successfully over a six-month period is a tribute to meticulous planning, dovetailed assembly schedules and a flexible electrical distribution system which could be tapped through plug-in outlets to provide immediate power to machines as they were delivered to the new plant and set in place. Illustrative of these plant-moving procedures is the case of a typical 5-ton lathe which was first worked overtime to create a small inventory, then disconnected one evening, trucked to Windsor Locks that night, shimmed in place and connected to the new duct network the following morning, and returned to productive operation by noon with a *total* downtime of 18 hours and a *production* downtime of only four.



RESEARCH CENTER at Utica covers 6½-acres, receives primary power at 115-kv (1), stepping this level to 13.8-kv at outdoor substation (2) before carrying it underground to main switchgear located in boiler house (3). Artist sketch shows these service facilities, also floodlighted parking areas (4), test powerhouse (5), air conditioning, load-center substations and experimental penthouses (6 and 7), and main entrance to 2-story office section.

ELECTRONICS for DEFENSE

Outstanding Electrical Construction

General Electric's new research and production center contains testing facilities without parallel, a thousand-cable central plug-board, automatic conveyors, a banked-secondary distribution system, thorough grounding provisions, numerous applications of photo-cell and magnetic-contactor control, a wide variety of voltage-frequency combinations, and many excellent lighting ideas. Wired by electrical contractors Langdon & Hughes of Utica, this plant is an outstanding example of top-flight engineering and construction.

ONE of the newest ramparts to be dedicated to our national defense program is a modern multi-million dollar plant in Utica, New York, designed solely for the manufacture of light military electronics equipment for our Armed Forces. Erected for the General Electric Company, it contains a total of 372,000 square feet of floor space, includes over 6½ acres of manufacturing area on a single floor, and represents some of the finest engineering, construction and production methods to be found in the country today.

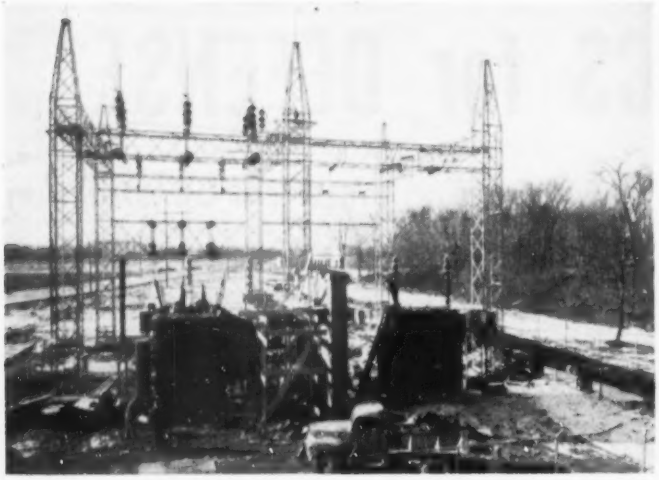
Outstanding physical features include test facilities without parallel in the industry, climate chambers wherein altitude conditions well beyond the present reach of the latest planes can be simulated, vaults where worldwide temperature and humidity conditions may be artificially created, massive shake-test stands to check the effects of vibration, a completely equipped machine shop and toolroom, custom-designed plating and painting facilities, an up-to-the-minute dispensary and all-electric cafeteria kitchen.

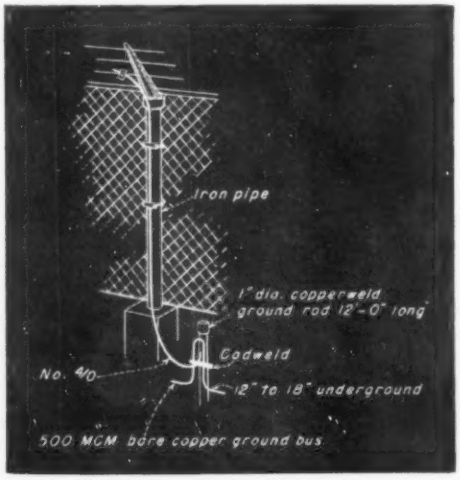
Electrically, the plant features a 72-foot long main plug-board with a thousand-cable distribution network, balcony-based power centers where all required voltages and frequencies are available, a grounding system second to none, 11 load-center substations, a basic 480/277-volt bus-duct system for general power and lighting, low-voltage control combining relays and magnetic contactors, an automatically controlled conveyor system, and extensive plant-wide networks for intercommunication, telephone service, sprinkler and fire alarms.

Designed and built by Walter Kidde Constructors, New York City, under the supervision of J. R. Anduson, it was wired by Langdon & Hughes of Utica. This plant merits mention as one of the country's finest industrial and research centers.

KINGSIZED MANHOLES and concrete- sheathed fibrecuts carry high-voltage cables between outdoor substation, main switchgear, test powerhouse and load centers. Manholes are equipped with cable racks, pulling eyes, insulators and conduit end bells.

BURIED FEEDERS are first placed in wooden forms, then racked in position, anchored and finally encased with poured concrete sheath. Ducts are shown before pulling of cables.



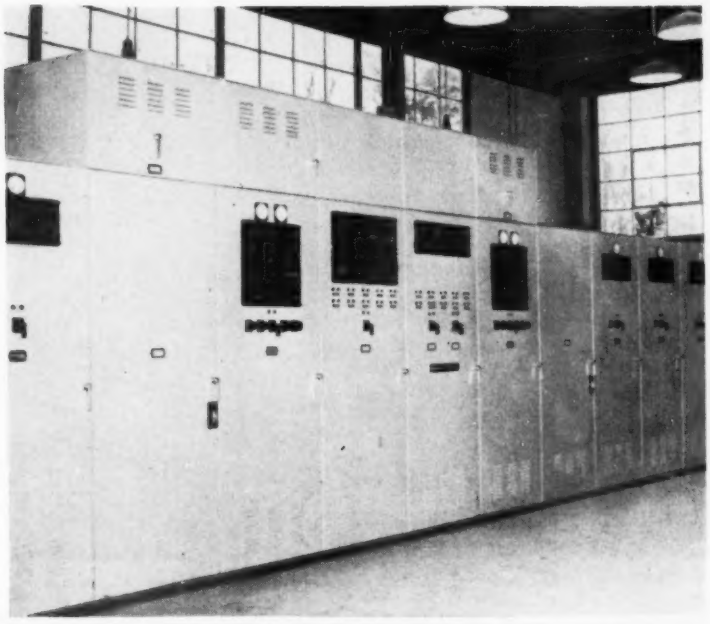


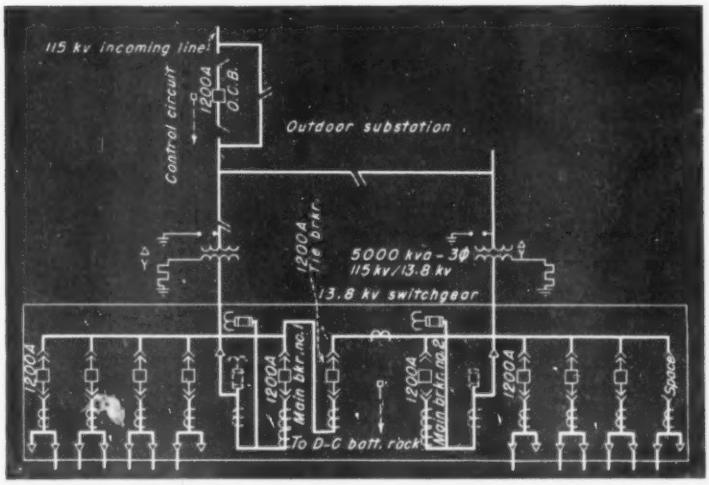
OUTDOOR SUBSTATION, delivered as ready-to-assemble "packaged" unit, includes twin 5000-kva transformers, complete steel structure plus all necessary breakers, disconnects and lightning arresters. Grounding of fence and all substation equipment is by Cadweld connections to Copperweld rods (see sketch).

Outdoor Substation

Incoming primary service is 115-kv 3-phase 4-wire 60-cycle ac, delivered overhead by pole line from the utility's aerial network to a completely-packaged outdoor substation. This station—factory-designed and manufactured as a coordinated unit—was delivered ready-to-assemble and install, with components including an entire 6-column hot-dipped galvanized steel structure, horn gap group-operated disconnect switches complete with manual operating mechanisms, OCBs pneumatically operated by 115-230-volt single-phase power, lightning arresters, low-voltage neutral grounding resistor, power transformers, 60-cell glass-jar 125-volt station battery and phanocharger for same. Since secondary underground ductlines, foundation pads and tower footings had been installed prior to delivery of this equipment, actual field erection consisted primarily of positioning, shimming, bolting and connecting this packaged equipment, then adding outdoor station lighting, fan racks, weatherproof lighting panel and fence enclosure. Field engineering was thereby reduced to a minimum, performance of coordinated parts was insured, and establishment of electrical service was greatly expedited.

Initial transformation is to 13.8-kv, through two oil-insulated fan-equipped 5000/6250-kva transformers connected delta on the primary side and, on the secondary, wye with neutral resistance grounding. Transformers are equipped with gas-oil tank seals, top oil dial thermometers with alarm contacts, manually-operated load-ratio taps to insure constant voltage output, auto-





MAIN SWITCHGEAR contains dual 13.8-kv buses connected through a normally-open electrically-operated OCB. All breaker compartments have elevating mechanisms, drawout relays, indicating bullseyes and CTs.

matically controlled fans to give continuous forced air ratings of 6250-kva, and 3/c potheads with uncut wiping sleeves for terminating secondary 500 MCM VCL cables.

Grounding for this outdoor station consists of a ring bus and laterals fabricated from bare stranded 500 MCM single-conductor copper cable buried a foot below the ground level just inside the fence line and Cadwelded to grounding rods spaced on approximate 16-foot centers along the bus line. All substation equipment, lighting arresters and rods, disconnects, towers, fencing and miscellaneous equipment is tied to this grounding net and the ground system, in turn, is connected to the grounding systems of the main manufacturing building, boiler house and other structures on the plant property.

Main Switchgear

Power is carried from outdoor substation to main indoor switchgear underground via fibreduct encased in concrete, ducts being aligned both vertically and horizontally and so staggered that no butt joints of adjacent ducts are in the same cross-sectional plane. Ducts entering manholes terminate in end bells, and manholes are equipped with Unistrut inserts for cable racks, pulling eyes and insulators.

During construction, unused ducts were kept sealed with wooden plugs to prevent the entrance of mud or other foreign matter and, during the pulling-in period, reels were set up on jacks, pulling sheaves and feeding tubes were used, soapstone lubrication was applied and pulling speeds were kept below 50 feet a minute to prevent damage to conductors. Pulling grips consisted of standard woven baskets.

To safeguard workmen, all previously-installed cables encountered in manholes and ducts were considered to be alive, and therefore were segregated by rubber sheets, wood blocks and barriers. Also, to protect cables against any possible fire damage, cables in trenches and manholes with insulation ratings of 2400-volts or above were fireproofed between duct entrances by half-lapped asbestos tape, tied with marlin cord and saturated with a solution of sodium silicate.

High-voltage cables in manholes—also at points of termination at outdoor substation and indoor switching center—are identified by means of lead stamped tags strapped to cables with lead strips. Cables below 600-volts are identified with tags of fibre.

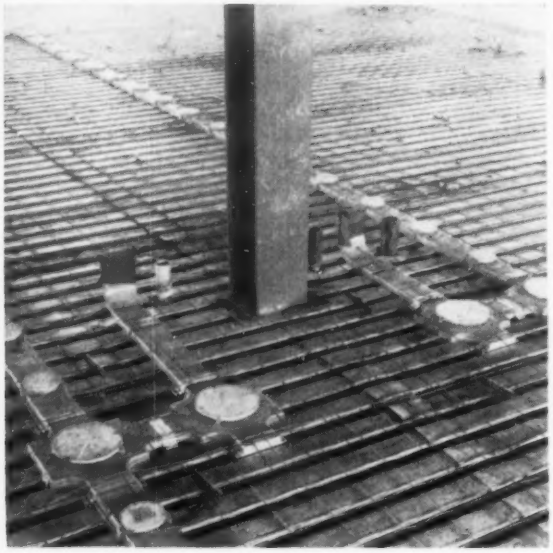
The main indoor metal-clad switchgear is in two sections, with the two 13.8-kv buses tied together through a 1200-amp normally-open vertical-lift oilless circuit breaker electrically closed and tripped with 125-volt dc.

Incoming and feeder breaker compartments are likewise equipped with 1200-amp ACBs with elevating mechanisms, also with overcurrent phase and residual drawout relays, manual handles to isolate the equipment for maintenance or inspection, red and green indicating lamps, and necessary current transformers.

Each feeder breaker compartment also contains dual 3-conductor potheads, with separate 3/c 4/0 VCL cable runs extending to secondary transformers at load-center subs.

At present, there are 11 strategically-located 1000-kva secondary substations, six supplying current for normal building-service power and lighting, and five used to furnish power for testing and special processing. Feeders to these subs are so connected at the main switching center that no double-ended station depends solely on one main breaker.

MODEL SHOP is provided with ample power by means of overhead plug-in busduct, general diffused high-intensity illumination from continuous troffers on 4-foot centers, sound dampening by an acoustical ceiling and air conditioning.



Q-FLOOR CELLS carry wiring for general office power and telephone service. End closures, junction units, vertical ells and couplings are installed as required to facilitate connections to floor outlets and column-mounted lighting panels.

Banked Secondary System

All normal building services—such as lighting, ventilating equipment, air fans, welding, conveyor systems, machine shop, plating and painting equipment—receive 480/277-volt 3-phase 4-wire power through two double-ended 2000-kva unit substations housed in penthouses atop the plant. Power is distributed at this voltage level by 4-wire 600- and 400-amp plug-in busducts that blanket the manufacturing areas, while single-phase dry-type transformers further reduce the current to either 240-volts (for kitchen power) or to 3-pole 240/120-v (for office lighting, incidental power and business machines).

Roof-based double-ended substations are equipped with air-filled interrupter switches on the incoming line side and they incorporate Pyranol-insulated transformers and manually-operated draw-out air feeder breakers having ICs of 25,000-amps, adjustable time-overcurrent protection and instantaneous short-circuit trips.

Secondary bus segments of both double-ended stations are tied together through twin 1600-amp normally-open electrically-operated breakers, while the load sides of *both* of these tie breakers in *both* substations are connected to a 1600-amp low-reactance bus-duct installation that links the two load-center subs into a banked-secondary system.

In addition, the mid-point of this 1600-amp bus-tie is tapped to the low-voltage breaker of a *third* substation, of 1000-kva capacity, which is a *reserve* unit installed so as to maintain continuity of power in the LVD bus system at all times.

Varied Wiring Media

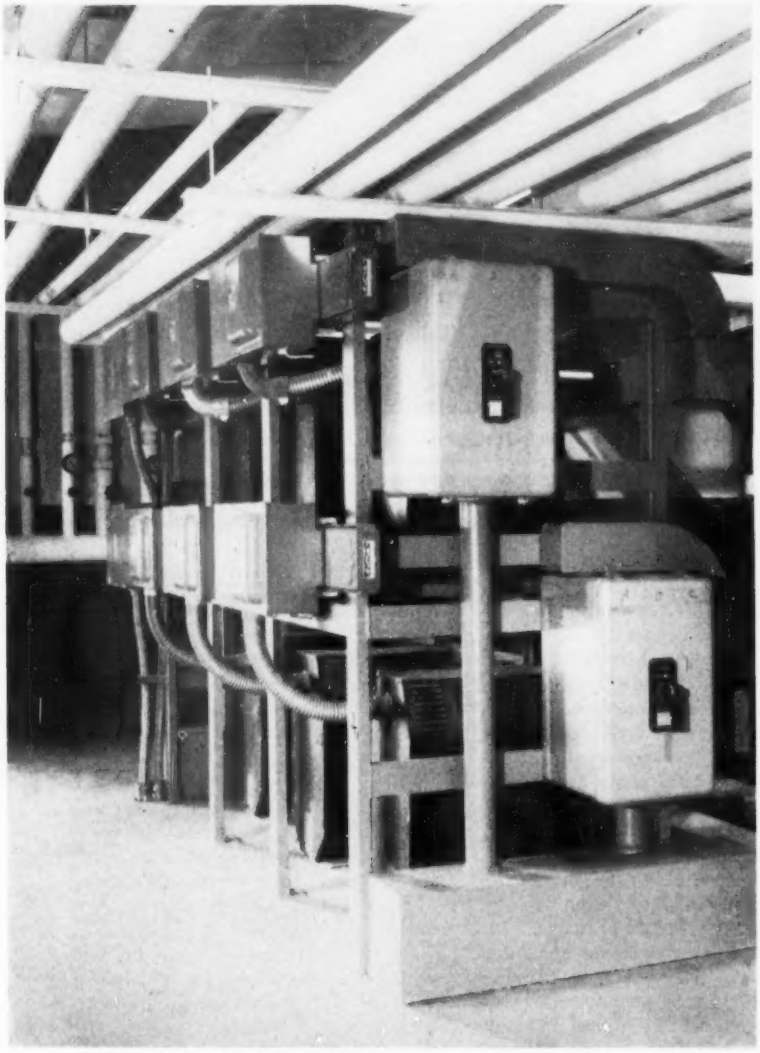
Aside from the bus-duct systems, distribution is via cables run variously in conduit, flexible couplings, cellular Q-flooring and 2-duct underfloor raceways.

Where installed, Fibreducts were securely fastened to floor slabs by means of cement mortar and were supported by couplings and leveling screws prior to the pouring of the finished floor. All conduits run in slabs were installed low enough so that Fibreducts could be installed level above them without changing elevation of the various duct runs between junctions.

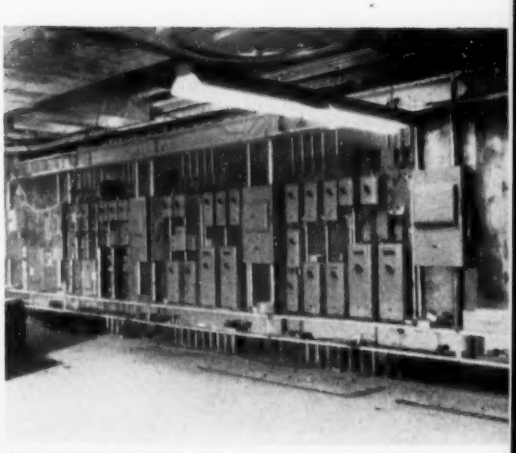
In areas where Q-flooring is used, headers were not placed in position until immediately before the application of fill, at which time they were installed with junction units on indicated centers, and were secured to steel floors at coupling points. Markers to identify the cells of each electrical system were installed on top of the cells in question and are now visible in the form of grommeted screws to facilitate the locating of otherwise unmarked wireways.

Throughout the plant, wire larger than No. 8 AWG is stranded. Secondary 600-volt feeders between substations and bus-ducts are 4-conductor varnished cambric, tape and braid protected by interlocked armor. Cable used for 2300-volt equipment is 3/c Super Coronol Geoprene. Feeder cables at the 13.8-kv level are varnished cambric, lead covered. All branch circuit wiring is color coded to designate the three phases plus the neutral wire in each cable run.

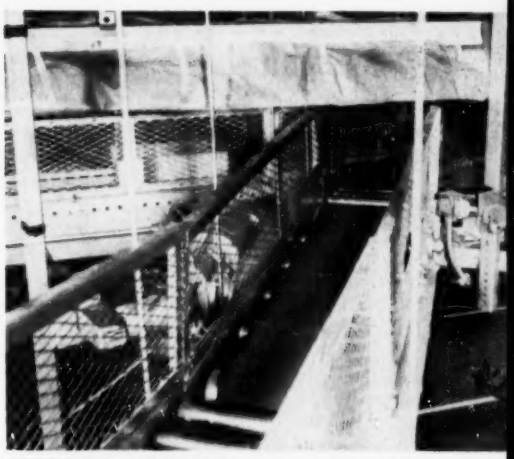
Lighting panels for control of branch circuits are designed for 100/240-volt service, with a solid neutral bar and single-phase branch breakers arranged in conventional order. Power panels are similarly arranged for 480-volt 3-phase; 3-wire 120/240-v, and 220-v single-phase solid neutral. All panels are dead front, either surface or flush-mounted, with solderless clamp-type main lugs, and with terminals for branch circuits consisting of washer heads with upset screws to prevent their complete removal from the bus strip.



SINGLE PHASE TRANSFORMERS are banked at local 240- and 120-volt load centers, stepping 480/277-volt current to lower potentials for such uses as office lighting and kitchen power.



WIRING TROUGHS of large cross-section, compact arrangement of well-mounted control panels, protective devices and special-purpose transformers, plus ceiling crowded with feeder conduit, ventilation ducts, lighting fixtures and piping provides indication of critical space requirements.



OVERHEAD CONVEYOR system is completely automatic, with individual motors driving the 24 separate sections, and photo-cell controls.

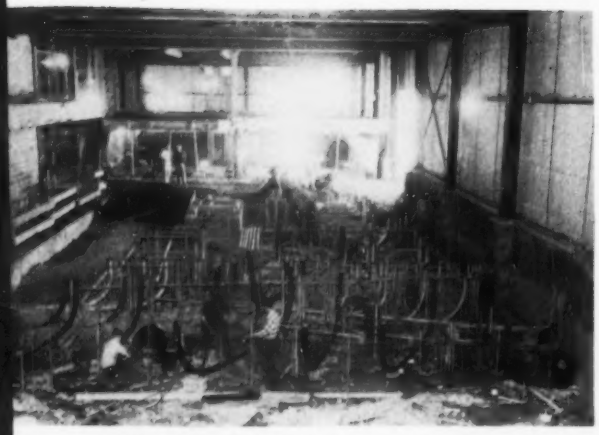
Automatic Conveyors

In this up-to-the-minute electronics assembly plant, raw materials and completed components are shifted from receiving docks to various stockroom bays by means of a completely automatic, remoteiy-controlled conveyor system that spans the factory in the roof-truss region. This system includes some two dozen sections, each section driven by its own drive motor. Jams at intersection points, that is, where two conveyors come together, are prevented by photo-cell controls. These controls are activated when packages on the conveyors interrupt light beams, and drive motors are temporarily halted by electronic relays.

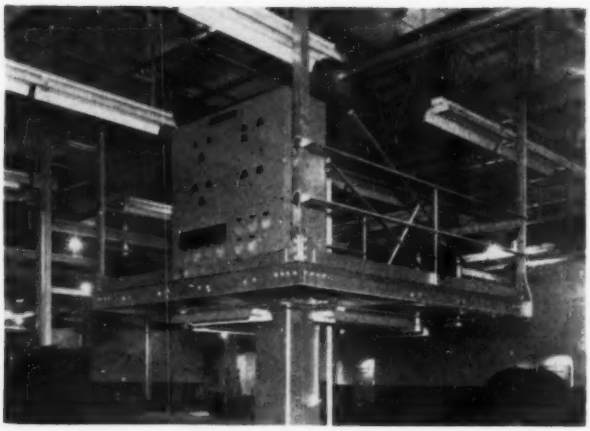
In the stockroom area, parts are transferred from the main conveyor to various branch lines by means of deflectors that shunt packages toward their intended destination. Closure and release of deflectors is by means of solenoids; their operation being initiated by steel balls which, when placed in various holes in the bottoms of conveyor baskets, make contact with the desired deflector switch. Packages are stopped where desired by limit switches.

With all material approaching intersections thus monitored by photocell detectors, traffic jams are impossible and damage to goods is eliminated. Also, with pre-routing provisions, multiple handling, with associated delays and the requirement for added personnel, is unnecessary.

This means of collecting and transporting parts is fast and positive, aisles are left unobstructed by pallet trucks and supervision is at a minimum. The system is just another indication of progressive methods in practical service, speeding the production of light military electronics equipment in the interest of national defense.



TEST POWERHOUSE contains 5 transformers having combined capacity of 5000-kva; 23 motor-generator sets for extensive voltage and frequency conversion, plus a giant plugboard to facilitate flexible power distribution. Powerhouse is shown prior to pouring of concrete.



TYPICAL TEST CENTER in factory area is mounted on platform constructed around structural column. Regulated ac is obtained through fixed connections while all other power requirements are provided through plug receptacles. Platform area behind test board is occupied by bank of 480-208/120-volt transformers.

Variable Voltages, Frequencies

For the purposes of compactness, convenience and efficiency, all power equipment related to testing or special processing is centralized in a "test powerhouse".

Essentially, this equipment includes a 200-kva double-ended 13.8-kv/480/277-v substation with a segmented secondary bus structure tied through a 1600-amp air breaker; a 1000-kva single-transformer sub with these same voltage levels; another 2000-kva double-ended 13.8/2.4-kv *single secondary bus* substation; 23 motor-generator sets to convert power to the many voltage and frequency levels required, and a 72-foot-long plugboard with distribution facilities for over a *thousand* connections between power sources and numerous test centers scattered throughout the plant.

With this assortment of equipment, it is possible to provide any desired combination of voltage (120/208; 240, 480, 575 and 2300; or 120, 240 and 480 regulated) and frequency (60; 210/420; or 66/22.5, 360/440, 400/850 and 750/1600 variable) for either 3- or 4-wire 3-phase ac service. Also provided is 32/64 and 125/250-volt 3-wire direct current.

Since reliable data was unavailable concerning the possible effect of these varied frequencies on impedance, many test studies were made prior to actual installation, to determine the best methods for minimizing voltage drop between stations. These tests indicated that the use of fiber ducts would avoid induced voltages in metal raceways, would eliminate mutual inductance and minimize circuit impedance. It was also found advisable to de-rate fuse-type circuit breakers when used in conjunction with above-normal frequencies.

As installed, all conductors between m-g sets and the plugboard are run either in conduit, or armored cable, first entering an 8-foot deep cable pit extending the length of the 72-foot-long board, then sweeping upward to the several bus structures in the plugboard. Feeders from the board to the various test centers in the plant are carried through concrete-sheathed fiber ducts. Inspection and servicing of these feeders is possible at manhole stations spaced along main feeder routes.

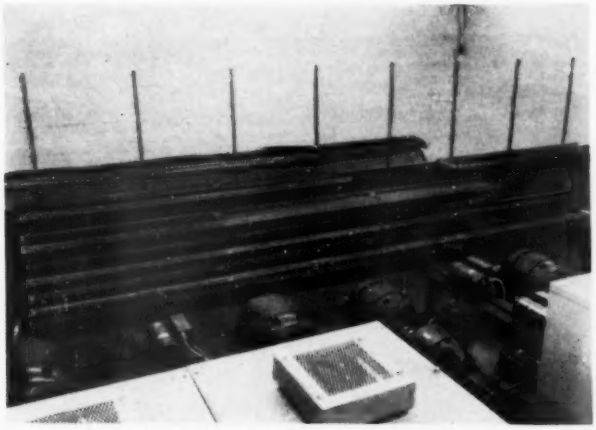
Platform-Mounted Cubicles

Three distinct types of test centers are installed in this progressive electronics development: elevated cubicles in production and assembly areas; shielded test rooms in special research areas devoted to the study of shock, vibration and atmospheric effects on equipment, and laboratory penthouses atop the office section for engineering development work.

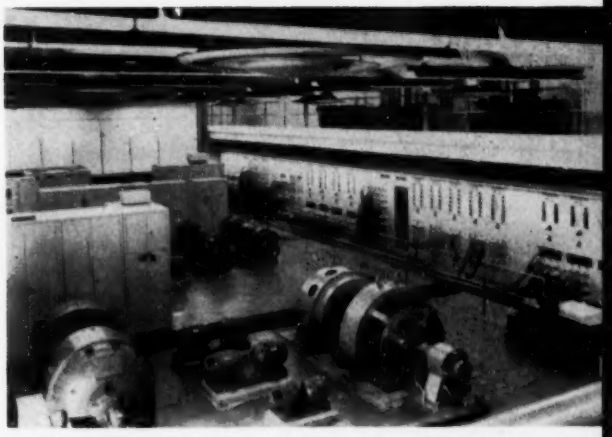
Elevated cubicles—18 in number—are mounted on 11-by-13-foot platforms secured to building columns approximately 8 feet above the production floor level. This method of mounting permits the placing of test facilities in centralized locations, segregating the equipment, and providing maximum unobstructed floor space for assembly benches and machines. Test cubicles, approximately 6 feet in height with 3-by-6-foot plan, are constructed of $\frac{1}{8}$ inch furniture steel and are equipped with 30- and 100-amp 4-pole 4-wire plug receptacles with spring hinged covers; 500-amp single-pole single-conductor plug receptacles of similar construction; 3-pole circuit breakers variously rated for 35-, 100-, 200- and 500 amps; remote control plugs, telephone jacks and keys. Also located behind the free-standing test cubicles on the same column- mounted platforms are 150-kva 480/120/208-volt delta-wye transformer banks.

At all test stations, regulated 120-, 240- and 480-volt 60-cycle current is obtainable through fixed connections, while all other desired combinations of voltage and frequency are provided through plug connections. Plug connections are made cooperatively by a technician at the test station and an operator at the plugboard, with communication between the various areas established via the telephone jacks and headphones.

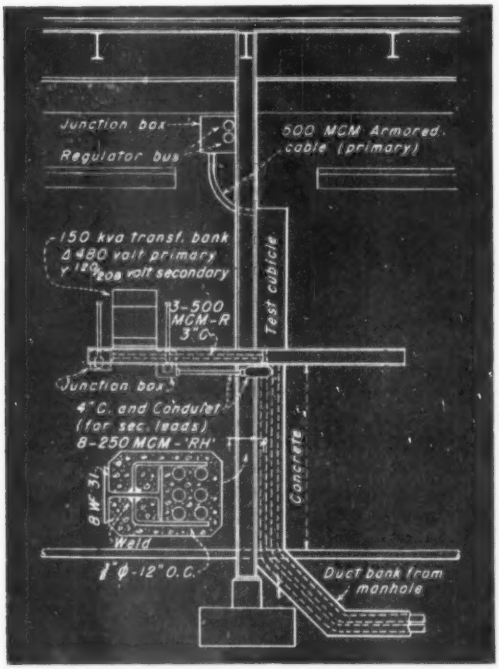
Feeders from the plugboard—distributed generally throughout the plant in underflow concrete-sheathed fiber ducts as previously mentioned—are carried upward to cubicle platforms along the structural columns. Reinforcing bars are welded to column



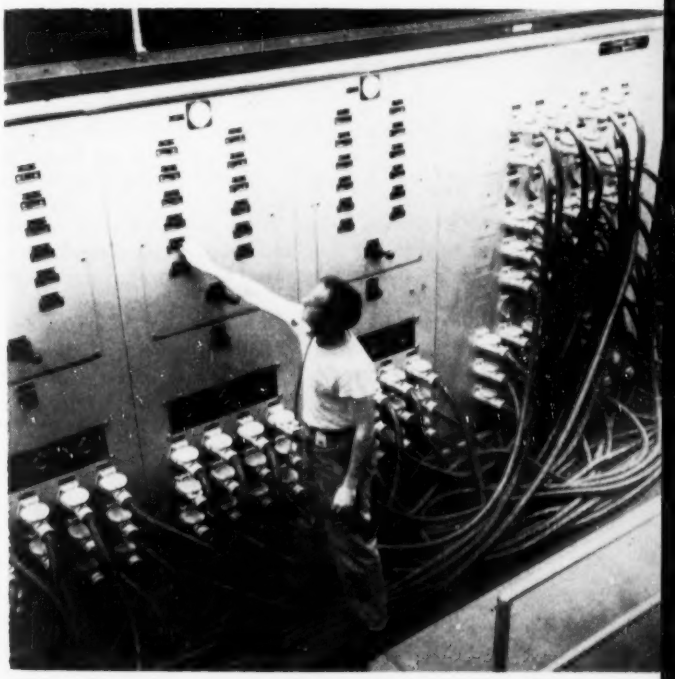
CONNECTION CABLES are conveniently stored near plugboard in series of expanded metal trays secured to wall by means of brackets and vertical perforated steel members held to concrete block surface by means of masonry expansion anchors. Suitable lengths are thus available for the desired patching.



PLUGBOARD has length of 72 feet and provisions for over a thousand connections between power sources and test centers. Available are 6 ac voltage levels between 120 and 2300, variable frequencies between 22.5 and 1600 cycles, plus 32/64 and 125/250-volt dc.

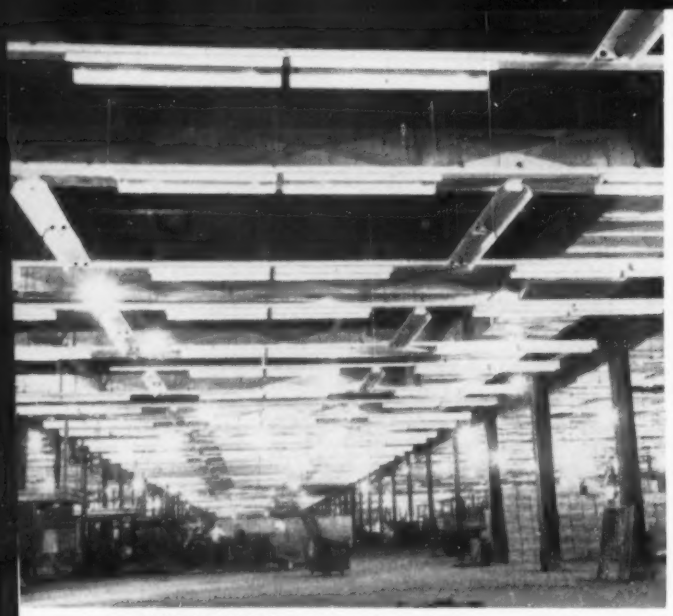


STRUCTURAL COLUMN, supporting test cubicle, is sheathed by reinforced concrete envelope that also encloses feeders originating at main plugboard. Overhead connection between test cubicle and regulator bus is via armored cable.

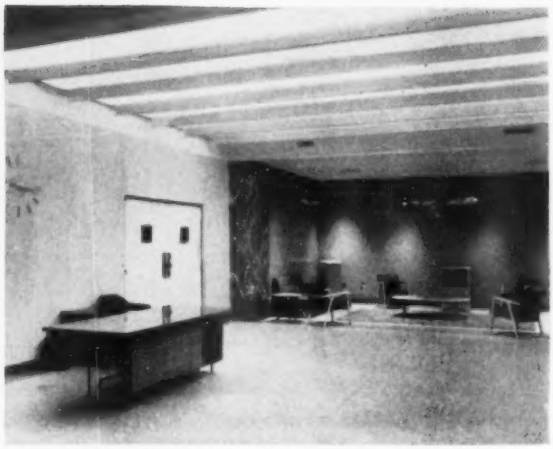


TECHNICIAN at plugboard, wearing headphones, is in constant communication contact with operators at various test centers, thereby guaranteeing immediate and accurate supply and regulation of all power requirements. Continuous overhead lighting trough floods face of board with even high-intensity illumination.

webs and bent around the ducts for protection, then the entire assembly is encased by concrete to form unit piers. Each test bench is initially powered through conduit drops from overhead plug-in supply bus-ducts or via test-cubicle flexible feeders. This supply is then passed through fused disconnect switches mounted on the rear of the bench and is made available to technicians through duplex receptacles positioned beneath the front lip of the bench, or through twistlock—or polarized receptacles mounted along square metal raceways running along the rear of the bench surface. Power having other characteristics is also obtained through 5-wire harnesses carried on lower shelves in metal raceway, and 12-prong Jones sockets located at the rear of the benches.



GENERAL VIEW of factory area during construction period shows close spacing of 2-lamp 85-watt 265-volt industrial open-end lighting fixtures mounted on continuous wiring channels. Use of magnetic contactors permits 120-volt remote control of lighting installation.



ENTRANCE FOYER has luminous ceiling formed by corrugated plastic sheets supported by wedge-shaped acoustical baffles. Backlighting is by rows of slimline lamps on 2-foot centers. Recessed downlights in lounge alcoves provide higher intensities for reading.

High Voltage Lighting

Since illumination in the plant is generally provided by 2-lamp 85-watt 265-volt Miller industrial open-end fixtures, it was possible to connect a large part of the lighting system, through magnetic contactors, directly to the 4-wire 480/27-volt bus-duct network. With continuous wiring channels installed uniformly through the plant, and with fixtures now mounted as 2-unit end-to-end groups with standard-length gaps between, it will be possible to increase the present light level of 65 footcandles to an intensity of 80-fc if this higher level is deemed necessary at some future date. Lighting fixtures are controlled by areas, each area measuring approximately 50-by-63 feet. Contactors are controlled remotely by pushbuttons operating at 120-volts potential. In all, there are over 9300 such fixtures in the manufacturing area of the plant, operating through approximately 60 contactors.

Lighting in the office-laboratory sections is conventional 120-volt fluorescent, designed on a modular basis with continuous rows spaced alternately on 3- and 4-foot centers. Troffers include both deep aluminum units with removable baffles, also shallow steel assemblies with hinged metal louver doors. Depending upon desired levels of illumination, troffers are variously 1-, 2- or 3-lamp units.

Lighting in the main lobby is provided by a Wakefield luminous ceiling, with white corrugated methyl mythacrylate sheets supported by perforated steel wedge-shaped acoustical baffles. Lamps, run in continuous rows above the ceiling on 2-foot centers, are T-12 slimlines operating at 430 milliamps.

In various sections of the office building, adjustable recessed incandescent spotlights and baffled downlights are used with fluorescent treatments.

Exterior lighting in parking areas includes both wide- and medium-beam 1500-watt tower-mounted floodlights equipped with either clear or stippled enclosing glassware; 500-watt twin-luminaire ornamental standard street lights; 10,000-lumen series-connected security lights along roof parapets and fence lines; 300- and 500-watt clear-glass Alzak reflector floods for roof walkways, and 25-watt refracting-glass step lights.

All cables for security and parking lighting are direct burial, trench-laid between layers of sand placed 30 inches below ground level. Light poles and towers, brackets and conduits are grounded either to the building structure or directly to 1-inch by 10-foot ground rods. All exterior junction boxes and lamp housings are weather-proofed. Security lighting is activated by photo-cell relays that automatically turn lights on when natural light drops below selected limits.

Extensive Grounding

Grounding of all structural steel and electrical equipment inside the plant is both comprehensive and thorough, with a bare stranded 4/0 copper grounding bus buried 12 inches below ground level and extending along each column line in the building. These parallel buses are cross-connected to each other at frequent intervals, are connected to earth via a series of 1-inch by 12-foot copperweld ground rods, are Cadwelded to every building column, and are also connected to the outside sprinkler water system at various points. Beneath areas where concentrations of electrical equipment occur—such as the main substation, switching center and plug-board—the grounding network is fabricated from 500 MCM cable.

In addition to this basic grid, a 2/0 copper grounding cable is run above and parallel to each bus-duct line, grounded not only at columns where source of power originates, but at all other columns along the routes as well.

Distribution systems are also grounded; the neutrals of wye-connected systems being solidly grounded at their sources; single-phase systems

Outstanding Electrical Construction

DRAFTING ROOMS, offices, research laboratories and similar areas are conventionally illuminated by continuous troffers installed on a modular pattern with row-to-row spacings alternating from 3 to 4 feet. Louvered troffers are either 1-, 2- or 3-lamp units, depending upon required intensity for the work.

supplied from single-phase transformers being grounded at the transformers; single-phase mid-taps grounded whenever possible, and neutrals of 3-wire dc systems also grounded at the sources. Only 2-wire dc systems having ratings lower than 300-volts are ungrounded, but these are provided with ground detectors.

Frames of rotating electrical equipment, 100-kva or larger, are grounded by direct connection to the building ground bus through conductors equal in size to the largest conductor in the line feeding the equipment, but never less than No. 6 AWG or larger than 4/0. This same method is followed for transformer tanks and associated equipment, also enclosing cases and supporting structures of major switchgear and control equipment.

Gounding aiso extends to circuit enclosure; with outer lead or armored sheaths of power cables grounded at all manholes and both ends, and all conduits, wireways, busways and junction boxes bolted or welded securely to the building frame which, in turn, constitutes a unified grounding system.

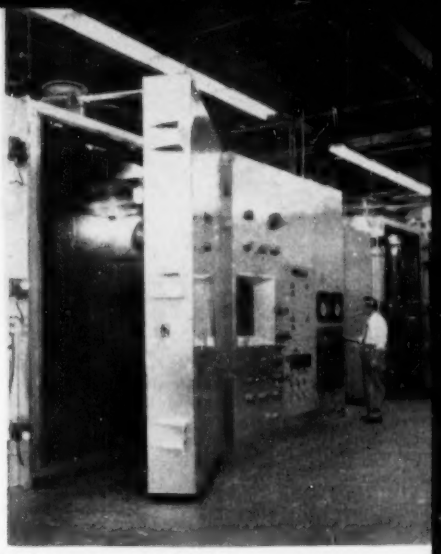
Stationary electrical equipment other than at main substations, also electrically-operated equipment throughout the plant, is likewise grounded to the structural frame of the building. In cases where ground conductors are run *inside* the conduit or raceway through which power is carried, the conductors are insulated and are equal in size to the largest conductor in the line, up to 4/0. This rule governing size also applies when the grounding conductor is run *outside* the raceway but, in these cases, grounding conductors are bare stranded cables or copper straps.

All buried ground connections are made by the Cadweld process, while all other connections are via approved pressure terminals.

Color coding identifies all grounding cables by green bands or sheaths, while neutrals are identified by white bands.

This unusually thorough grounding system not only provides maximum safety but insures optimum testing conditions for the many sensitive electronic devices located in this defense center.

The construction of this military electronics plant at Utica augments the facilities of G.E.'s now-famous Electronics Park at Syracuse, and segregates all defense work from the many commercial lines being manufactured for the electronics field by General Electric. The new plant also furthers security, expedites vital production and promotes serious research. It is a complete self-contained entity—an American investment in national preservation.



RESEARCH EQUIPMENT includes massive climate chambers where wide ranges of altitude, humidity and temperature conditions can be artificially created to aid analytical study of their effect on equipment.

RECEIVING PLATFORM in trucking bay is equipped with motorized roll-up doors, unit electric heaters for cold-weather use, planned lighting, annunciation system and hydraulic loading ramp.

MODERN KITCHEN, bakery and cafeteria contains electrical provisions for expeditiously preparing, cooking, storing and serving appetizing food for employees in this outstanding electronics research laboratory.

Electrical Installations in the Petro-Chemical Industry

A discussion of National Electrical Code requirements for Class I Hazardous Locations

By B. Z. Segall

THE installation of electrical systems in hazardous portions of industrial plants concerned with petroleum development is governed basically by the minimum requirements of the National Electrical Code. A general discussion of the Code requirements cannot cover specifically each problem that will arise in designing electrical systems for refinery buildings, chemical by-products buildings, etc., but it is believed that a presentation of the principles of construction as outlined by the Code together with some of the related background and examples of equipment involved will be of considerable aid in laying out such installations, setting up maintenance programs for their upkeep, and understanding the general problems involved. While certain recommended changes to the 1951 Code will affect these principles to a certain extent, they have not as yet been fully developed for inclusion in the 1953 Code and will not be considered here.

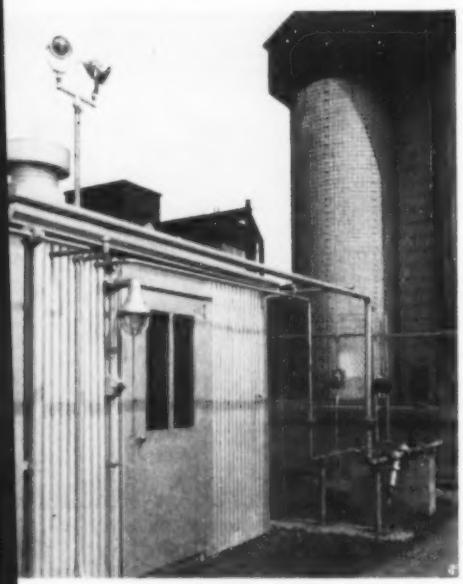


FIG. 1. Outdoor application of lighting fixtures in hazardous location.

Classification

Article 500 of the National Electrical Code sets up three main classes of hazardous locations, I, II and III, identifying locations which contain flammable gases or vapors, combustible dusts, and ignitible fibres or filings, respectively. A further general classification is set up for locations in which readily-ignitible deposits or residues from paints, varnishes, lacquers or other types of finishes may be present, and Article 510 presents the requirements for electrical installations in gasoline service stations, bulk-storage plants, and other specific occupancies.

While an extensive development including chemical manufacture in addition to petroleum refining and storage, bulk-storage plants and retailing outlets could conceivably be concerned with all these regulations, the greatest portion of electrical installations in the production and refining of petroleum and its allied chemical products are covered by the regulations governing Class I locations.

Recognizing the fact that one location may be hazardous to a greater extent than another, the Code has set up construction standards for two general types of locations, designated as Division 1 and Division 2. Their definitions as given by the Code are given in Table I.

Hazardous locations are further subdivided into atmospheric groups, Groups A through D applying to Class I locations. These subdivisions, defined in Table I, recognize the variations in explosive characteristics of the various gases and vapors. A short discussion of what is meant by "explosive characteristics" is in order.

For practically every flammable liquid, gas or vapor there is a minimum concentration of the gas or vapor in air below which flame propagation will not occur when the gas or vapor is caused to be ignited. Similarly, there is a maximum concentration point beyond which flame propagation cannot be maintained. If these concentrations are expressed as percentages, the range between this low and high percentage concentration of gas or vapor in air is known as the explosive range for this particular gas or vapor. The larger the explosive range, the more hazardous are the areas containing these gases and vapors considered to be. Table II gives explosive ranges for representative gases and vapors in each of the four atmospheric groups.

General Requirements

Wiring installations for Class I locations are designed to withstand explosions of gases and vapors which are inherently a part of the manufacturing process. From a practical and economical standpoint the wiring system cannot be made so vapor-tight or so gas-tight as to exclude all these gases and vapors from the conduit lines, switches, pull boxes, junction boxes, etc., in the electrical system. The many screw threads, operating shaft openings and similar points of entry found in the wiring system and apparatus will "breathe" in the gases and vapors, regardless of how small and restricted these openings may be.

The basic principle of design for the electrical system, therefore, is to have sufficient strength in its various components to resist pressures developed by internal explosions of such gases and vapors. The arcing and sparking of switches, heating elements and similar devices may cause explosions within the system, but proper design and installation can prevent disruption of the conduit or enclosures. Containing such explosions within the system more or less eliminates the possibility of igniting adjacent explosive atmospheres.

Since a large explosive range creates a greater possibility of explosions, equipment, apparatus and fittings must be designed not only for Class I hazardous locations, but specifically for one of the four atmospheric groups A, B, C or D.

The authority responsible for enforcing the Code is the sole judge of requirements applicable to each specific installation. He must approve the group selection (A, B, C or D) considering, as the Code states, ". . . each room, section or area (including motor or generator rooms, and rooms for the enclosure of control equipment) . . . individually in determining its classification." Many electrical inspectors, through a study of recorded industrial experience of hazardous operations and of the accepted standards of the National Fire Protection Association, have done a creditable job in assisting industry to develop safe electrical installations in hazardous locations. Others have considered the work beyond the scope of their normal activities and have transferred the responsibilities of classification to some other competent inspection agency or have set up procedures whereby these other agencies are required to concur in their opinions. In any case, the Code-enforcing authority, whether he be an electrical inspector, a local fire marshal or other local rating inspector, should be consulted before preparation of the wiring layouts.

Specific Requirements

The problem of classification must be solved so as to leave no reservations or doubt in the mind of the Code-enforcing authority as to his recommended solution. Class I Divisions 1 and 2, as defined in Table I, were set up in an attempt to liberalize the Code requirements when warranted by existing conditions. In the following discussion of the requirements of these divisions, the numbers in parentheses refer to and correspond with those used in Table I.

Division 1 (1): Examples of hazardous concentrations occurring during normal operations would be a process requiring open-type vats or mixers which continuously give off gases or vapors, or an apparatus which expels a slug of gas or vapor to the surrounding air at regular or irregular intervals. The relative concentration of the gas or vapor in the air must be studied to determine whether or not the concentration is within its explosive limits. Although good ventilation may keep the concentration far below the explosion point, it should not be relied upon to eliminate entirely the need for installing special equip-

TABLE I. CLASS I HAZARDOUS LOCATIONS

- **CLASS I LOCATIONS Are Those** in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures.

- **CLASS I, DIVISION 1 LOCATIONS Are Those**

  (1) in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions;

  (2) in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage;

  (3) in which breakdown or faulty operation of equipment or processes which might release hazardous concentrations of flammable gases or vapors might also cause simultaneous failure of electrical equipment.

- **CLASS I, DIVISION 2 LOCATIONS Are Those**

  (1) in which flammable volatile liquids or flammable gases are handled, processed or used, but in which the hazardous liquid, vapors or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment;

  (2) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, but which might become hazardous through failure or abnormal operation of the ventilating equipment;

  (3) which are adjacent to Class I, Division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate, positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

- **CLASS I ATMOSPHERIC GROUPS:**

  Group A: Atmospheres containing acetylene.

  Group B: Atmospheres containing hydrogen or gases or vapors of equivalent hazard such as manufactured gas.

  Group C: Atmospheres containing ethyl-ether vapors, ethylene or cyclopropane.

  Group D: Atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer solvent vapors, or natural gas.

TABLE II. FIRE-HAZARD PROPERTIES*

GROUP	GASES & VAPORS	EXPLOSIVE LIMITS Per Cent by Volume		EXPLOSIVE RANGE Per Cent by Volume
		Minimum	Maximum	
A	Acetylene	2.5	80	77.5
B	Hydrogen	4.1	74.2	70.1
C	Ethyl Ether	1.85	36.5	34.65
D	Ethyl Alcohol	3.5	19.0	15.5
	Acetone	2.55	12.8	10.25
	Natural Gas	4.8	13.5	8.7
	Naptha	1.2	6.0	4.8
	Petroleum Ether	1.4	5.9	4.5

**National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives, 1943*

ment. One small pocket of gas or vapor, such as may exist in a conduit line, switch enclosure or terminal box, is sufficient to cause an explosion and resulting fire.

(2): Many operations such as chemical processes usually require a complete cycle of operations to be completed before a shutdown can be made, since interruptions would completely spoil the materials or necessitate expensive salvaging operations to reclaim the materials. As insurance against shutdowns during these operating periods, repairs and maintenance are scheduled between cycles. During these periods of maintenance flammable gases and vapors will escape into the atmosphere of the plant, their concentrations being in many cases sufficient to form an explosive mixture. Processes using newly-developed materials present another source of leakage, since techniques for handling the materials are not always perfected before their use. Other leakage problems arise due to the normal aging of piping, valves, and other equipment.

(3): All equipment and processes are subject to breakdowns, but not all breakdowns are likely to result in explosive conditions. A location should be classified as belonging to Division 1 if in the opinion of the Code-enforcing authority its equipment or processes are so arranged that any breakdown is likely to cause a simultaneous release of flammable gases or vapors and faulty operation of its associated electrical equipment.

Division 2 (1): In general, requirements for Division 2 locations are less severe than those for Division 1 locations. The normally confined operations of this section differ from Division 1 (3) above in that, in the opinion of the Code-enforcing authority, there is no danger of sparks or arcing from faulty electrical equipment to cause an explosion in case of equipment breakdown.

(2): The use of ventilating equipment properly applied and engineered may often permit installations to be made with standard wiring systems and equipment. However, a good ventilating system cannot earmark a location as being less hazardous until a study has been made by the inspecting authority to determine whether the system will definitely limit the concentration of the gas or vapor below the lower explosive limit.

(3): Although an area in a building may be cut off completely by walls and doors from a Division 1 location, a special classification is needed for such an area. The normal operations in the building may require frequent movement of materials between the two areas, so that the adjacent area may have occasional hazardous concentrations of the gases or vapors from the Division 1 area for which special electrical equipment may be required.

It is evident from a consideration of the above that a great deal of responsibility lies with the electrical inspector in determining which classification most nearly fits the installation in question. The spillage of hazardous materials from many systems due to equipment breakdown may be calculated with a great deal of accuracy and compared with known explosive ranges of the gases involved to determine the possible hazard. However, there are many places in a plant where such leakage can accumulate undetected. Dead air spaces in areas containing enclosures, and even enclosures in well-ventilated areas, can easily serve to trap concentrations of gases or vapors in a location which would normally be classified as non-hazardous.

For reasons such as this, some inspectors have ruled out entirely the Division 2 concept and require complete compliance with Division 1 requirements throughout any hazardous or potentially-hazardous locations, feeling that the borderline between

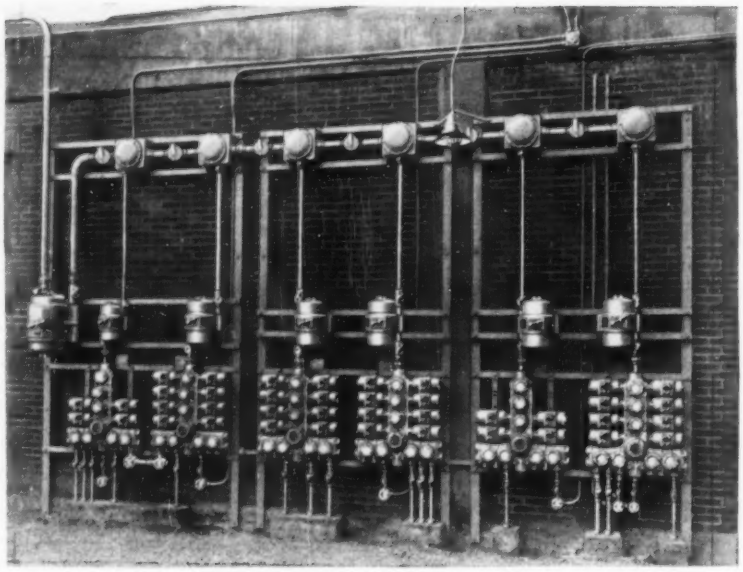


FIG. 2. Hazardous location installation using six explosion-proof panelboards.

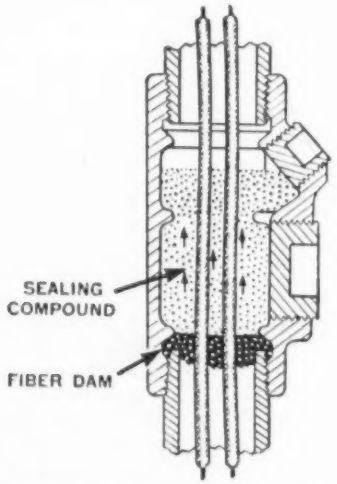


FIG. 3. Representative seal for conduit runs. Protection is provided against passage of gases or vapors from bottom to top.

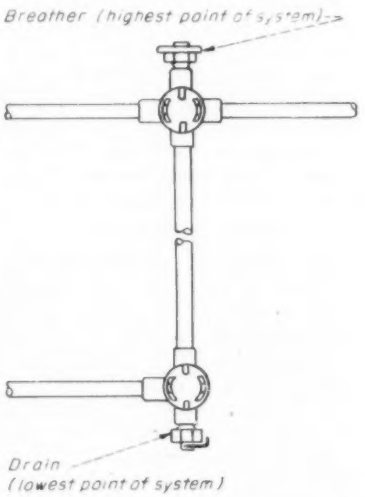


FIG. 4. Breathers, to permit escape of warm air, and drains, providing means for removal of accumulated water, add life and efficiency to system.

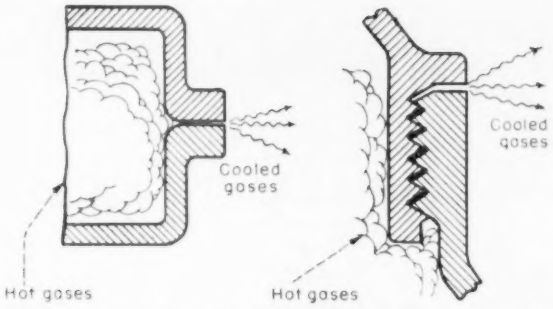


FIG. 5. Controlled cooling of exploded gases through flat joints (left) and threaded joints (right) depends upon the dissipation of heat into the metal flanges.

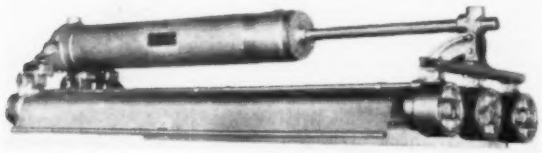


FIG. 6. Fluorescent lighting fixture of explosion-proof design.

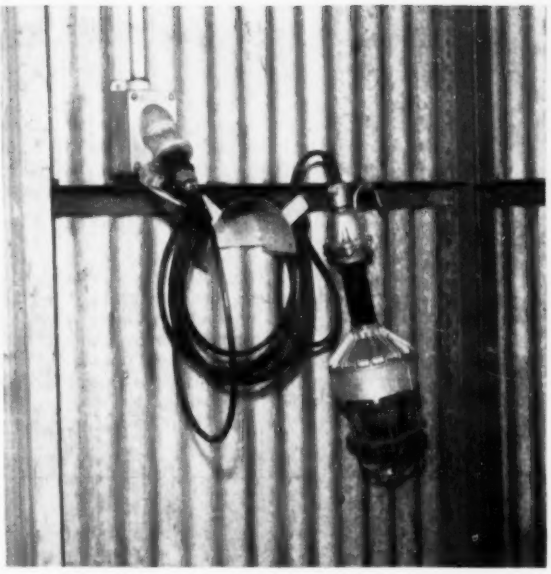


FIG. 7. Portable lamp and explosion-proof receptacle.

safe and unsafe construction is not as clear-cut as set forth in the classifications of the Code. In some cases this principle is justified economically, the increased safety of the electrical system accruing savings from lowered insurance rates.

Wiring Methods

Conduit and Fittings: Table III gives the requirements of the Code regarding Class I wiring. In general, a study of the explosive forces capable of being generated by the gases and vapors involved result in conduit and fittings which will withstand internal explosions. However, the efficiency of any installation is dependent entirely upon the workmanship of the mechanic making the installation. Of particular importance are the conduit runs themselves. There are cases where faulty threading of conduits has actually introduced hazards into the wiring system. In making field threads, dies should be used with stops to limit the number of threads cut. The total number of threads which should not be exceeded will vary from approximately 7½ for ½-inch conduit to 12 for 6-inch conduit. Tapered dies with a nominal taper of ¾-inch per foot should always be used.

Where necessary to provide flexible connections, explosion-proof flexible couplings are available. They are manufactured in various types combining male and female nipples and unions in trade diameters from ½ to 2 inches, and in lengths from 4 to 36 inches. These couplings cannot be bent as sharply as is usually permitted for standard flexible conduit. Usual minimum bending radii are as follows:

Conduit (Inches)	Radius (Inches)
½	10
¾	12
1	14
1¼	16
1½	16
2	18

In general, mild steel, cast iron or malleable iron are used for the conduit, fittings and enclosures. Certain installations, however, require other types of metal. For example, the corrosive action of ammonium nitrate powder when wet or damp on steel and zinc, principal constituents of conduit and fittings, make aluminum advisable in installations concerned with the production of ammonium nitrate. Although this compound is not classified as a hazardous product under the Code, it is processed from natural gas, and this association warrants electrical construction equal to that used for Class I, Group D installations.

Some fittings may be furnished with an aluminum finish for certain applications, the finish consisting of a baked vinyl base, zinc chromate primer and a heavy aluminum lacquer. However, some of the finish is very likely to be scraped off during installation, requiring touching up of damaged sections upon completion of the job. Often the extra care necessary in installation plus the touching up process exceeds the cost of using all-aluminum fittings in the first place. Where brush coating is required, several grades of primer are available. One such primer is known as Wash Primer No. 1, Military Specification MILP-15328. It must be protected by a finish coat of high quality aluminum lacquer.

Sealing: Assuming the design of a system has given it sufficient strength to withstand rupture in case of an internal explosion, the next requirement is to provide sufficient sealing devices to prevent the spread of gases, vapors or flames from one part of the system to another through the conduit. In addition to preventing exploding gases from escaping into the atmosphere and causing additional explosions, proper sealing protects the system against the danger of "pressure piling." This term refers to the building up of pressure of unexploded gases within the conduit system caused by an explosion in some part of the system. The primary explosion transmits its effects to adjacent gases in the conduit and enclosure, and a secondary explosion of this compressed gas or vapor has many times the destructive power as an explosion of the same gas at atmospheric pressure.

Seals used may be of several types, all depending upon some type of compound to block the passage of the gas or vapor. Some are made to be mounted in any position; others are restricted to either vertical or horizontal mounting and provide protection in only one direction. This point must be carefully considered in installing seals between hazardous and nonhazardous areas, since the improper

TABLE III. CLASS I APPROVED WIRING

- **DIVISION 1:**

  Rigid metallic conduit with threaded explosion-proof joints, and explosion-proof boxes and fittings, shall be the wiring method employed. All threaded joints shall be made up with at least five threads fully engaged. Where necessary to employ flexible connections, as at motor terminals, flexible fittings approved for Class I locations (explosion-proof) shall be used.

- **DIVISION 2:**

  Threaded rigid metal conduit or threaded electrical metallic tubing using approved fittings with standard pipe thread dimensions shall be the wiring method employed. Where provision must be made for limited flexibility, as at motor terminals, flexible metal fittings, or flexible cord approved for extra hard usage and provided with approved bushed fittings shall be used. An additional conductor for grounding shall be included in the flexible cord unless other acceptable means of grounding is provided.

TABLE IV. CLASS I SEALING REQUIREMENTS

- **DIVISION 1:**

  1. Seals are required in each conduit run entering an enclosure for switches, circuit breakers, fuses, relays, resistors or other apparatus which may produce arcs, sparks or high temperatures.
  2. Seals shall be located in each run leaving a Division 1 area.

- **DIVISION 2:**

  1. Each conduit run entering an enclosure which is required to be approved for Class I locations must be sealed.
  2. Each conduit run passing through a Division 2 area to a non-hazardous area must be sealed off.

positioning of the seal may allow the gas or vapor to enter the system beyond the sealing compound and escape to the non-hazardous area. The effectiveness of the seal depends entirely upon the proper filling of the fitting with an approved compound, installed strictly in accordance with the manufacturer's recommendations. The Code prohibits splices or taps in sealing fittings and establishes the minimum compound thickness as being no less than the trade diameter of the conduit, in no case less than ⅝-inch. Fig. 3 shows the construction of a typical seal.

Much Class I equipment contains built-in sealing fittings, and additional seals are not required. The six explosion-proof panelboards shown in Fig. 2 have sealing devices installed by the factory for each branch circuit breaker compartment; however conduit lines feeding these panelboards are equipped with external seals.

Table IV gives the general sealing requirements of the Code for Class I installations.

Draining: Free circulation of air is stopped in parts of a wiring system which are sealed off in accordance with the Code, causing water vapor in the entrapped air to condense and accumulate within the enclosures. After a while this water will corrode the equipment parts and cause the housing itself to deteriorate and become hazardous. Accordingly, the Code stipulates that where such entrapped water vapor is probable, "approved means shall be provided to prevent accumulation or to permit periodic draining of such water or condensed vapor." Although outside temperature changes and heat generated by current flow cause periodic expansion of the air within the parts of the system with a resultant "breathing out" of some of the entrapped vapor, it is by no means entirely expelled in this manner.

Special draining fittings have been developed for explosion-proof systems which may be periodically opened to remove accumulated water. Some are combined directly with sealing fittings; others are meant for water alone or water under oil. In the oil type an additional valve is built into the drain to prevent oil leakage. The valve must be opened periodically until the oil begins to appear in the drainage.

Often the removal of warm air in risers and enclosures before condensation will eliminate some water. This may be accomplished by the use of special fittings called "breathers." The proper use of breathers at high points and drains at low points, as illustrated in Fig. 4, will add much life and efficiency to the system.

Equipment and Materials

General Construction: Explosion-proof equipment is defined by the Code as being enclosed in a case which is capable of (a) withstanding an explosion of a specified gas or vapor which may occur within it, and (b) preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

The first provision is a matter of designing the enclosures of proper metal and contours with sufficient thicknesses. Standardized laboratory tests check these designs to be sure they will withstand internal explosions.

Fulfilling provision (b) invloves the principle of controlled cooling of the exploded gases or vapors as they are allowed to pass out of the system into the atmosphere. The joints between covers and enclosures, motors and end bells, etc., are constructed of two standard types to provide such passage.

The first depends upon very accurately machined flat surfaces, set up as relatively wide flanges on both the cover and the enclosures, the two being held together very tightly by machine bolts. Close tolerances are required for the space between the two flat surfaces, since it is the exit passage for the exploded hot gases. The width of this opening and the length of the flanges are designed to absorb sufficient heat during the passage of the gases through the opening to limit their temperature to a safe value by the time they reach the atmosphere outside the system.

The second type of construction employs threaded joints. Here again sufficient metal is provided to cool the hot exploded gases as they escape from within the enclosure, the path in this case being around the threads.

In general, the threaded type of construction is superior to the flat joint. Flat surfaces may become scratched or dented to permit flame passage, or a loose cover screw may cause an extra-large opening to exist. On the other hand, if threads are damaged, the joint will not seat properly and the defect will be brought to the attention of the mechanic during the installation. Another advantage of threaded joints is that an explosion will tend to force the threads closer together and further restrict the opening, while flat surfaces will tend to be forced farther apart. See Fig. 5.

Specific Equipment: Electrical equipment approved for installation in

(Continued on page 273)

BUSINESS OUTLOOK

1. MANUFACTURING BUSINESS particularly in durable goods, is off a bit.

2. THERE ARE THOSE who think that any decline in prospect in this sector will be offset by increases in the soft goods business and the provision of services. Consequently, they expect the economy as a whole to roll on into 1954 on a pretty even keel. We expect the downs to overbalance the ups enough to lead to some modest decline in business as a whole—a decline which we have characterized as from super-boom to prosperity.

3. THE DECLINE COULD be accentuated if the jitteriness which afflicted the stock market recently were to permeate the business community more generally and lead to cut-backs and cancellations of business plans.

4. THERE IS NO EVIDENCE, however, of such contagion. On the contrary, a very large volume of new securities continues to be sold in anticipation of capital expenditures to come. If the plans foreshadowed by these security flotations go ahead on schedule, we shall have a key ingredient of a high level of continuing prosperity.

By Dexter M. Keezer

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McGraw-Hill Publishing Co.

IN a recent report on business prospects, we observed that some of the most fundamental measures of business activity—construction, steel output, durable good sales, manufacturers' new orders—had begun to turn down. Anyone who examines the report of "Economic Indicators" prepared by the Council of Economic Advisors can see this neatly laid out in charts and tables.

The Federal Reserve Board's index of industrial production, which is probably the most widely used measure of activity in manufacturing and mining, stood at 235 in September, compared with 243 in March of this year. Twelve of the 16 manufacturing industries included are now operating at lower levels (seasonally adjusted) than they were earlier in 1953.

On the other hand, dollar measures of total business activity—such as the gross national product, which includes output of all goods and services at market prices—still show no decline. Many service activities, including state and local public services, are still increasing, as are consumer expenditures for non-durable goods. And a small rise in average retail prices has helped to hold up the dollar volume of business.

There are some economists of high standing who argue that a continued rise in expenditures for soft goods and services will offset the drop in durable goods production and enable business activity as a whole to keep an even keel well into 1954. We conceive this to be a possibility and would enjoy embracing it as a probability. At this juncture, however, it seems to us that the downward forces are exerting too much pull to justify confidence that another rolling readjustment, as it has euphoniously come to be known, (increases in some segments of business to offset declines elsewhere) will bring the economy through on an even keel or better.

Instead we continue to anticipate some falling off in business as a whole —a prospective decline which we have recently characterized as that from super-boom to a high level of prosperity. However, we readily concede that what is going to happen in the period immediately ahead is sufficiently unresolved to leave room for a wide range of psychological responses on the part of the business community, with attendant adjustments in business plans.

The psychology of the business man is a subject much talked about, but little studied. However, our own observation would be that the business community, while increasingly concerned about the outlook, is today in a far calmer state of mind than in 1929 or 1949, so far as this concerns sharply cutting or cancelling important programs.

Stock Market Jittery

The only real attack of jitters so far is in the stock market, which has recently taken its worst tumble in over two years. The market has often gone in a direction opposite to business activity. And it almost always exaggerates the trend in one direction or the other. But a recent survey by *Business Week* found businessmen investors genuinely worried about the short-term outlook and showing it by getting out of equities.

You can also see evidence of the businessman's reluctance to take short-term risks in recent inventory policy. The press has carried numerous statements by leading executives of a determination to reduce inventories. And although we have no really recent figures on inventory accumulation, the trend of bank loans to business—which are mostly inventory loans—is not up as sharply as many observers had predicted.

But financing for new plant and equipment has not been seriously affected. In fact, it's going on apace. On September 16, one of the largest amounts of new securities (mostly bonds) ever offered in one day was sold to the public without difficulty. In addition to a huge new issue by the New York State Thruway Authority, private companies raised money to build electric power plants, chemical plants, telephone lines and railway equipment. Obviously the issuers, the bankers and the investors all thought that now was a good time to go ahead with such projects or the securities

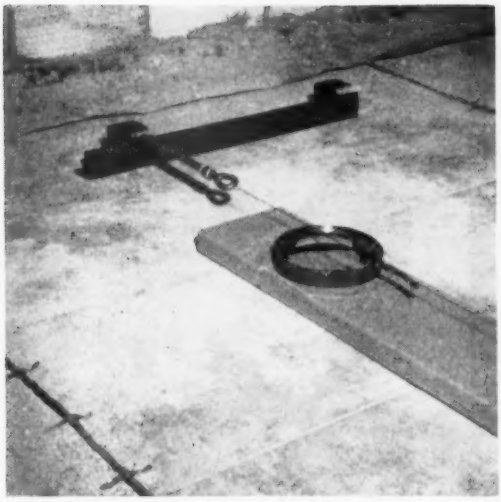
(*Continued on page 271*)

IDEA MAN F. J. Somes, Jr., Motor City vice president, shows dies he used to turn out steel grommets. Hydraulic flanging tool to lock header duct to floor panel with grommets was his idea, too.

Contractor Ingenuity

SPEEDS HEADER DUCT INSTALLATION

at Detroit's new City-County Building. Motor City Electric Co., develops hydraulic grommeting tool to tie duct to cellular steel sub floor panels; eliminates straps.



INITIAL LAYOUT STEP was mounting of alignment bracket for dual duct line. Turnbuckle tightens steel wire under which header junction units are centered. Parallel ducts are on 18-inch centers.

PILOT HOLES are drilled in cellular steel floor immediately after header is aligned. Drill is guided by sleeve template whose circular base centers pilot holes in pre-set handhole openings.

FLOOR ACCESS HOLES are cut with 3-inch holesaw on shaft extension of 5/8-in., 450 rpm electric drill. Duct and guide wire are pushed aside so all holes can be drilled before duct is assembled. Alternate method is to cut holes as header is coupled and assembled.

HEADER duct is being installed at a record pace at the new City-County Building under construction in the heart of Detroit's growing Civic Center. A combination of imagination, ingenuity and faith in its own ideas, led Motor City Electric Company, subcontractor for the duct system, to develop a new method of mounting the duct to the cellular steel sub floor throughout the buildings.

The twin office and court structures (one 14 floors and one 20 floors) require some 440,000 sq. ft. of Fenestra-Nepco Electrifloor—a new type of steel rectangular-cell floor panel supplied and installed by the Detroit Steel Products Company. To provide the ultimate in electrical flexibility, architects Harley, Ellington & Day, specified dual runs of header duct to feed predetermined floor cells (used as conductor raceways).

A large area header ($1\frac{3}{8}$ in. by $6\frac{1}{8}$ in.) was engineered and supplied by National Electrical Products Corporation specifically for this type of floor construction. It was delivered to the project in 8-foot lengths with two preset, 3-in. diameter access holes on approximately 48-inch centers per section. Duct was custom-tailored at the factory to fit the structural plans. Straps were furnished to fasten the duct to the floor, as were aluminum

A FEW SWIPES of a file remove burrs from floor opening so grommets will lock header firmly to floor panel.

HYDRAULIC TOOL, developed by Motor City Electric, flanges steel grommets in about 30 seconds to firmly anchor 6-3/8-in wide header to steel floor panel.

DOLLY-MOUNTED hydraulic motor follows mechanic down the duct line as he flanges

grommets (flanged sleeves) to provide a smooth perimeter for the access to panel cells. Hand tools were provided to flange the grommets.

Normally, the duct would have been installed in the conventional manner. However, Fred Somes, Jr., Motor City vice president, had other ideas. A visit to the job convinced him that considerable installation time could be saved by further mechanization and use of power tools. As an aftermath of the visit, Somes came back with a few preliminary sketches of a hydraulically operated flanging tool. He had the tool built so it could be used with the conventional portable hydraulic motor.

A second idea presented itself. Why not use steel grommets for the aluminum ones and firmly tie the header to the floor panel during the grommeting operation? No straps would then be necessary. Somes had enough faith in his idea to invest some $3,500 in "tooling up". This included the hydraulic tool and a set of dies to make the grommets from 0.015-in. annealed (dead soft) cold-rolled steel stock. A zinc coating prevents grommets from corroding.

Tests conducted on the initial run of header installed by this new method were successful. Dislodgement tests failed to move the duct. Approval of the architects and city electrical inspection department was granted to the contractor. Underwriters' Laboratories, in a revised listing report, makes this statement: "when two grommets are used per length of Headerduct no steel straps are needed." With this encouragement, Somes standardized on this technique for the rest of the project. His ideas paid off.

Actual time for installing a grommet with the hydraulic tool is now about 30 seconds. Add to this total elimination of duct strapping and you have some idea of the man-hour economy.

Installation procedure follows a fairly set pattern as indicated by the accompanying sequence pictures. Duct

steel grommets. Formerly grommeting was done with a hand tool.

FINAL STEP IS CAULKING of coupling joints to prevent ingress of moisture during concrete pour.

layout starts with a T-fitting at a panel location, with 8-foot sections added to each end of the fitting until the header line is complete. After the duct is centered along an aligning wire, pilot holes are drilled in the floor panel at each preset handhole. A special template guides and centers the ½-inch drill. After pilot holes are finished, the duct is pushed aside and the access holes are cut with a special holesaw made for about $75. The saw is fabricated of mild steel, case hardened; has a $\frac{3}{32}$-in. thick wall; carbide-tipped teeth; and fits a standard holesaw arbor. Only two sharpenings of the fast-cutting saw were necessary during the installation.

Burrs are removed from the openings and the duct relocated for the grommeting operation. Steel grommets are placed on the flanging tool which is inserted in the panel opening. When the tool is held perpendicular, the flanging dies are locked in place. A twist of a valve at the tool applies the hydraulic pressure and the grommet is flanged. The final step involves caulking coupling joints to keep out moisture during the concrete pour.

Flanging grommets with a hand tool was slow and tiresome. With the hydraulic unit, it is quick and easy. Mechanics like it. The 34 floors of this building no longer look as big to the header duct crew. It's almost a "breeze" from here on in with their new tool. Again an enterprising electrical contractor has made an important contribution to mechanization of electrical construction operation. It is a representative example of the dividends that are often realized through a little forethought and experimentation before plunging headlong into a large operation, despite the fact that an initial outlay of cash is usually necessary.

When tools are needed and are not available, contractors make them. They do it every day. It's part of that intangible commodity they call service.

Moulded contour ceiling in theatre contains special reflective surfaces, provides ideal arrangement and typical example for . . .

Mobile Color Lighting

Principles of color blending, fundamentals of application for dramatic color effects, color lighting systems, and methods for control are described and discussed in detail.

By Rollo Gillespie Williams

Color Lighting Consultant
Century Lighting, Inc.
New York City

MOBILE color lighting concerns successive colors of light. The colors may be clearly separated by intervals of time or may dissolve into one another. Available colors may range from a system with three or four hues in a fixed sequence, to one with a near-infinity of hues and tints pre-selectable in any desired order. Thus lighting and control methods vary considerably and extend from a single lamp with movable filters to elaborate multi-color installations with electronic controls.

There are many methods of obtaining colored light from electric lamps. Incandescent filament lamps can be provided with colored glass or color coated bulbs, while standard white lamps may be used in conjunction with colored filters. Electric discharge lamps will directly produce colored light according to the type of gas used in the bulb, or the latter may be coated with a composition of fluorescent powders to convert lamp energy into light of the desired color. The choice of method is dictated by many considerations, including lighting distribution and color quality, as well as lighting efficiency. In the case of color blending systems, the method of dimmer control is also an important factor.

Most mobile color lighting systems employ the principles of color blending, and vary the lighting intensities of two, three, or four over-lapping colors of light to produce a range of resultant color mixtures. Apart from intensity control and blending, the extent of the effects will largely depend upon the spectral energy distributions of the individual colors, as will be seen from the following brief consideration of the functioning of the eye.

How the Eye Sees Color

Color is a phenomenon of vision and, according to the Young-Helmholtz theory, results from stimulation in different degrees, of three sets of nerves or receptors in the retina of the eye. While each set is responsive to some extent to a wide range of wavelengths in the visible spectrum, each one is sharply responsive to part only of the spectrum, and the three sets are therefore often referred to as corresponding

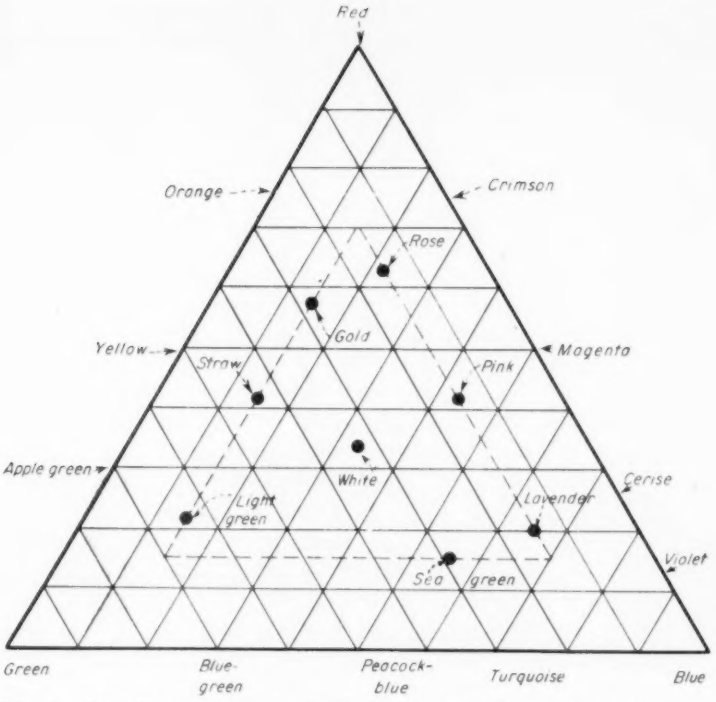


FIG. 1. Color Triangle showing all possible blends of three primary colors.

to "red", "green", and "blue" light. Simultaneous full excitation of the three nerve sets produces the sensation of "white", while different degrees of stimulation produce the sensations of "color". Thus the radiant energy distribution of normal daylight fully stimulates all these receptors, whereas selective reflection—as from colored objects—of certain wavelengths only, causes different degrees of response from the primary sensations, so that "color" is perceived. Thus purple is the result of stimulation of the "red" and "blue" receptors, yellow of the "red" and "green" receptors, and peacock-blue of the "green" and "blue" receptors. Pastel colors and tints are the result of stimulation in some degree of all three sets of receptors.

Mobile color lighting utilizes "primary" colors in the lighting system to directly stimulate the color receptors in the onlookers' eyes, while blends of these primary colors produce the appearance of other colors according to their relative retinal excitation.

The appearance of pure deep colors can only be produced when one or two sets alone of the retinal color receptors are strongly stimulated, because excitation to any extent of all three sets causes the appearance of pastel or pale colors. Since the eye "sees" white when all three sets are fully stimulated, the nearer the relative stimulations approach this condition, the "whiter" or "paler" a color appears. Thus it is very important to employ pure color filters when a large range of resultant effects is required from a color-blend system. The word "pure" is used in the sense that each color has a relatively narrow spectral wavelength band. The widest range of results are obtained when the color lighting system includes circuits of pure red, pure green, and pure blue light, because these correspond to the basic sensitivities of the three color receptor sets in the eye. Thus three-color installations using white incandescent filament lamps behind carefully chosen red, green, and blue filters, will provide a much larger color range than installations employing incandescent lamps with color coated bulbs, owing to the greater spectral purity of the separate filters.

One simple method of checking the color purity of red, green, and blue filters, is to hold a pair of different colors together in front of a white light and note the color and amount of light transmitted. If the filters are truly monochromatic, little or no light will be transmitted, and none at all through the three different filters held together. When they have a wide spectral distribution, there will be light transmitted through all three filters held together, and considerable light of a bright color seen through pairs of different filters. The hue of the transmitted color will indicate the extent that the wavelength bands of two filters overlap each other.

The Color Triangle

The range of colors that may be produced by mixtures of red, green,

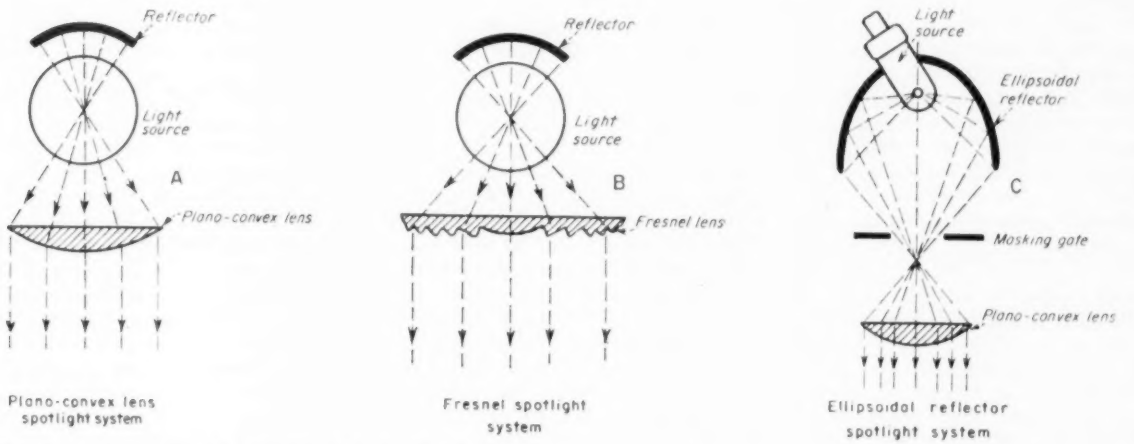


FIG. 2. Some systems of directional light control with lenses.

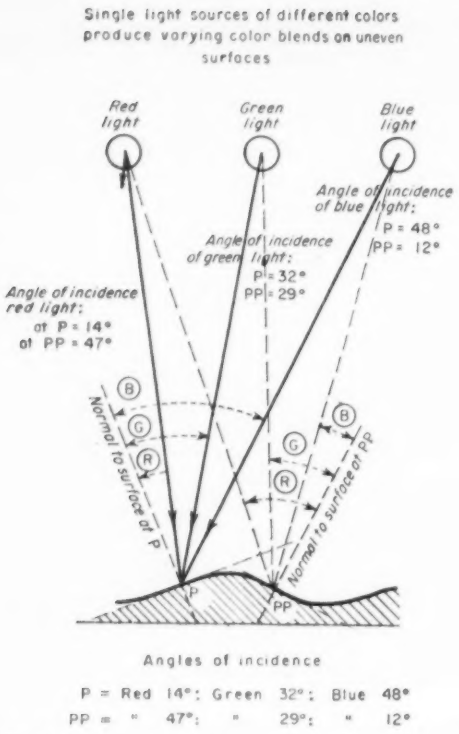

Single light sources of different colors produce varying color blends on uneven surfaces
Red light
Green light
Blue light
Angle of incidence of blue light: P = 48° PP = 12°
Angle of incidence of green light: P = 32° PP = 29°
Angle of incidence red light: at P = 14° at PP = 47°
Normal to surface at P
Normal to surface at PP
P
PP
Angles of incidence
P = Red 14°; Green 32°; Blue 48°
PP = " 47°; " 29°; " 12°

FIG. 3. Lighting distributions that would blend on flat surface have differing values on uneven surface.

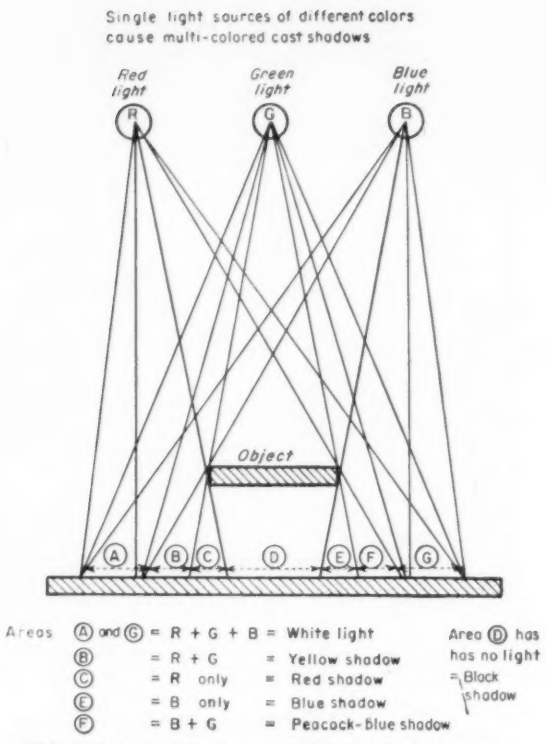

Single light sources of different colors cause multi-colored cast shadows
Red light
Green light
Blue light
Object
Areas (A) and (G) = R + G + B = White light
(B) = R + G = Yellow shadow
(C) = R only = Red shadow
(E) = B only = Blue shadow
(F) = B + G = Peacock-blue shadow
Area (D) has has no light = Black shadow

FIG. 4. Cast shadows become multicolored, thus broadening the range of dramatic lighting effects.

and blue light of reasonable purity is shown in Fig. 1. The triangle should be imagined as a white surface with a colored light at each corner, as shown. The intensity of light from each lamp is considered to proportionately diminish as the distance between the lamp and a line parallel with the side opposite to it, increases—zero intensity being reached at the opposite side. Thus along the outer edges of the triangle will be found all possible mixtures of colored light from each pair of lamps, while at a point in the triangle equidistant from all three lamps, the intensities will be such as to produce white light. At other positions *inside* the triangle there will be mixtures of light from all three lamps in proportions to produce all pastel colors and tints—the colors getting deeper nearer the triangle edges and paler nearer the point "white". Some of the color mixtures are named as shown.

Filament Lamps Preferred

The necessity for red, green, and blue primary colors of reasonable spectral purity, is one reason why mobile color-blend lighting has been mainly carried out with incandescent filament lamps and color filters, because so far, fluorescent light sources have not been available in colors of sufficient purity to provide the same wide range of color effects. Cold cathode fluorescent lamp color blending installations have been often used and have many economic advantages, but the spectral energy distribution of the sources allows only a limited range of hues to be obtained by mixture, and many important deep colors are unobtainable. Furthermore, it is difficult to arrange the lighting so that equal intensities of red, green, and blue light are available, owing to the different lighting efficiencies for these three colors, which are in the ratio of around red 1, blue 7, green 19, in lumens per watt figures.

Thus incandescent filament lamps are at present the best light sources to employ for a mobile three-color lighting system when a wide range of deep colors is necessary, and especially when colors such as orange-yellow, deep violet, cerise, and peacock-blue are required. Acceptable color blending results can usually be obtained from equal wattages for the red, green, and blue filters, although an increase of 50 to 100% for the blue is desirable. Sometimes the green filter transmits rather more light than the red filter, and then the green load can be around 80% of the red load. In these cases an excellent arrangement would be lamp loads in the ratio of green 4, red 5, blue 8, assuming filters of reasonable color purity.

Color filters should be durable and not fade or lose their hue, else the installation will soon lose its effectiveness. Glass filters are excellent in this respect and can usually be obtained in acceptable colors. When gelatine or other non-durable filters are employed, the lighting is sometimes allowed to get into pretty bad shape before filters are changed, and this may bring an installation into disrepute. It is certainly wise to provide filters that will stand up indefinitely—also steps should be taken to see that they are cleaned regularly.

Good Diffusion Desirable

It is very important that colors are properly blended and that resultant hues are not marred by patches of the individual "primary" colors, else it will be difficult to create the desired effect, since subtle color differences will be missed owing to the inability of the eye to properly judge the effects while looking at bright areas of primary colors. The requirements for perfect diffusion between adjacent lamps of the same color, and excellent blending between lamps of different colors, raise problems when incandescent lamps are required to provide smooth lighting on

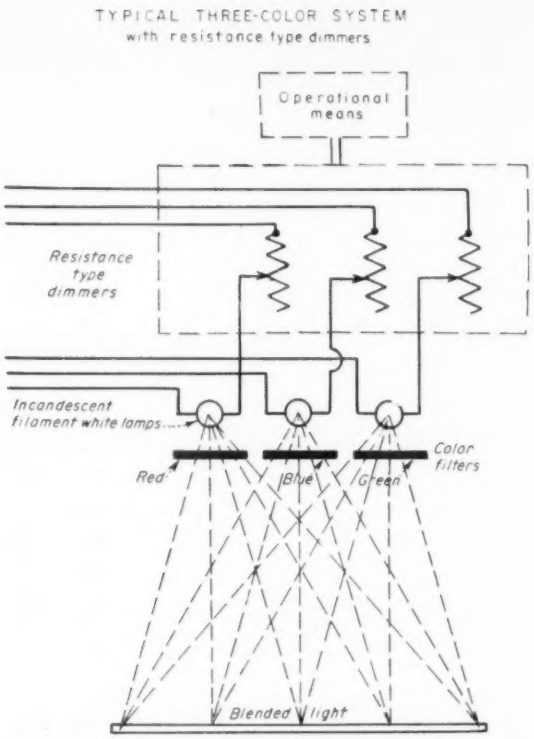


FIG. 5. Three-color systems can match the tints produced by four-color systems.

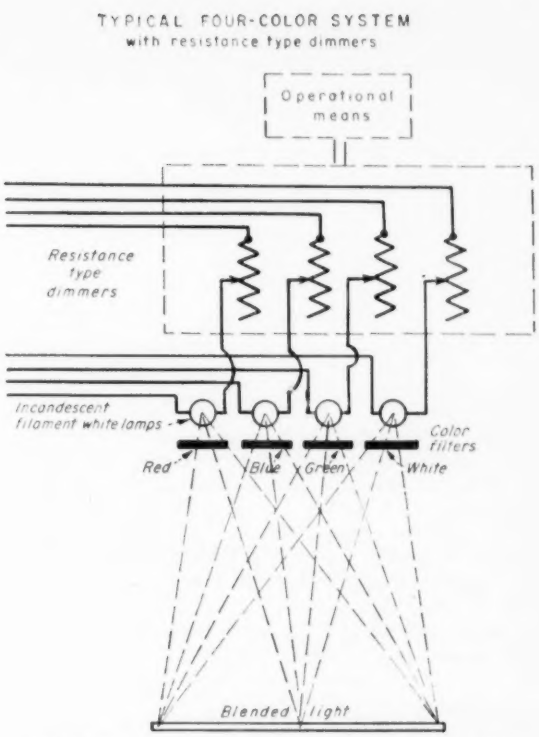


FIG. 6. The addition of white light to three-color system produces near-white as well as deeper colors.

near surfaces, since only every third lamp (with a three-color installation) can be of the same color, and the center to center spacing may be greater than desired. Lighting distribution and blending are factors that often require special reflector or diffusion arrangements in the lighting equipment.

Fluorescent tubular lamps or tubing have many advantages when diffused lighting is required, and when they become available in suitable red, green, and blue primary colors, will undoubtedly provide the answer to many problems of diffused color lighting. Until then, the choice of method for diffused lighting of near surfaces appears to lie between incandescent lighting with excellent color range but difficulties of perfect color blending, and fluorescent lighting with excellent blending but limited color range. When long throw directional lighting is required, then the advantages at present rest with incandescent lighting.

Producing Pastel Colors

Mobile lighting installations frequently require pastel and near-white colors as well as deeper colors, and a fourth circuit of white light is often added for mixture with the colored light. This results in tints with a higher lighting intensity than would be obtained from three-color lighting alone, although the color of the tints can be matched by the latter, as is shown in Fig. 5. Thus the red, green, blue and white circuits form a four-color system. On occasions, the fourth circuit is yellow instead of white, to enable hues and tints with a yellow base to be obtained at high intensities.

Color Lighting Equipment

Incandescent lamp equipment frequently takes the form of lighting strip, with sockets spaced at 4″ centers for 100 watt lamps, and 6″ centers for 150 watt lamps. When lamps with colored bulbs are employed, the strip is often a plain channel casing, but sometimes a continuous reflector is mounted along its length. When standard general service type white lamps are employed with separate color filters, it is usual to mount them in individual reflectors with the color filters held in hinged or spring-front rims. The reflectors are usually made of aluminum and can have either a specular or diffuse finish, so that with a choice of either clear or frosted lamps, a range of lighting distributions is available.

PAR-bulb or R40-bulb reflector lamps are often used in conjunction with color filters held in a metal clip fastened to the lamp bulb. A choice of lighting distributions according to lamp type is thus available, and directional characteristics may be further provided by mounting the lamps in swivel sockets. There is apt to be some leakage of white light from the inside of the color clips or from the lower neck of reflector-lamp bulbs at times, and when this is undesirable, the lamps may be mounted inside a divisioned casing so that all outgoing light must pass through the color filters.

Glass roundel color filters with prismatic formations to provide light control are available, and are very useful in spreading light between adjacent lamps of the same color, so that color blending is facilitated. These filters can be used with either separate reflector units or reflector lamps.

Generally speaking, the use of separate reflector units in conjunction with frosted lamps, provides better diffusion on near surfaces between units of the same color, compared with reflector lamps, while the latter provide better directional lighting characteristics when the lamps are at a distance.

When several lamps of each color combine in lighting a surface, it is usually not difficult to avoid color variations or colored shadows, but when one lamp only of each color is em-

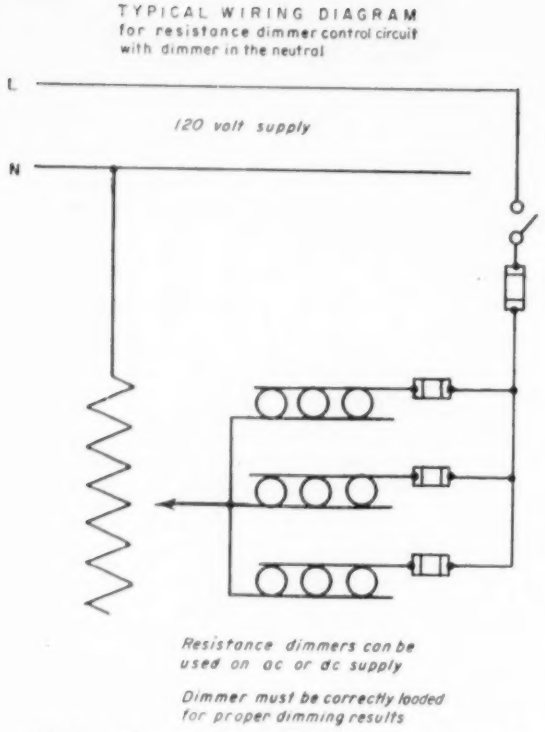


FIG. 7. Resistance dimmers can be used on either ac or dc circuits, but are limited in application refinements. Typical Wiring Diagram for resistance dimmer control circuit with dimmer in the neutral.

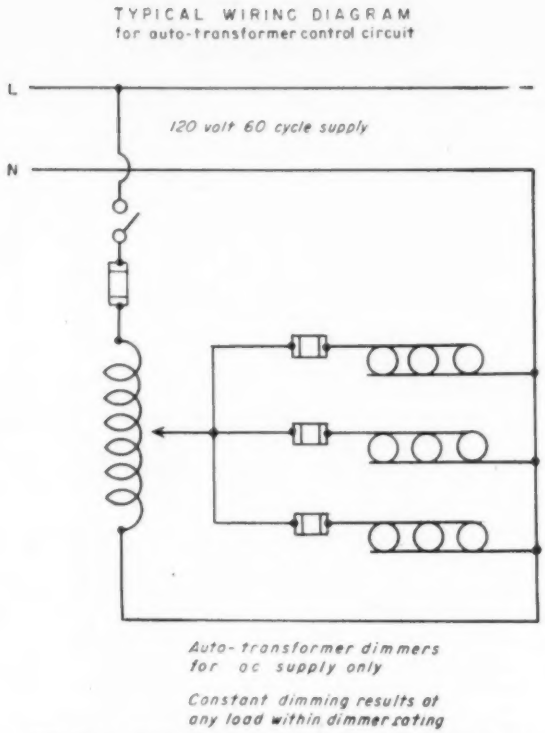


FIG. 8. Auto-transformer type dimmers provide constant and flickerless dimming on all loads. Typical Wiring Diagram for auto-transformer control circuit.

ployed, as may be the case with sharply defined directional lighting, it is difficult to avoid this phenomenon, especially if the surface is uneven, since the angle of incidence from each lamp is difficult relative to a specific point on the surface. Thus lighting distributions that would blend on a plain flat surface are given differing values on an uneven surface, as shown in Fig. 3, causing variations of color, while cast shadows become multi-colored (Fig. 4). To avoid these color shadows and variations, it is necessary to cover each point of surface from different angles. This means two or more sources for each color, unless a special reflector or lens system is employed to integrate the light from one lamp of each color into a single beam of blended light.

Dimmer Systems

Equal in importance to correct primary colors and color blending, is the factor of lighting control, which concerns both brightness control units and their operational means. Brightness control units for incandescent filament lamp loads are usually called "dimmers", and control the output of light by varying the lamp voltage. Cold cathode fluorescent lamps are also primarily controlled in this manner, but recent developments in the regulation of light output from hot cathode fluorescent lamps involves different principles, as for example the control of ballast impedance by reactors, or adjustment by electronic means of the time during every half cycle that current flows through the lamps (see EC&M, February 1953, pp. 70-73). However, while "brightness control" would be a more general term than "dimmer", owing to the association of line voltage variation with the latter, the fact that all brightness control systems can "dim" the light output of lamps, results in all control units, regardless of method, being known as "dimmers".

Dimmers for varying lamp voltage are available in several types, including resistance, auto-transformer, reactor, and electronic tube types. Resistance dimmers can be used on either ac or dc circuits, but generate heat when in "check" and will not give constant dimming results on a widely variable load. Auto-transformer type dimmers are for use on ac circuits, and provide flickerless and constant dimming results on all loads within the normal capacity of the dimmer. Reactor dimmers are particularly suitable for large ac loads and for remote control, since small dc currents are employed to control the saturation of the ac reactors, and intricate control arrangements from remote positions are more easily arranged. The dc reactor circuits are sometimes controlled by small resistance dimmers, but more frequently by electronic tube equipment in conjunction with potentiometer control units. An important recent development is the dimming of lamp loads *directly* by electronic tubes in conjunction with potentiometer controls.

While it is important that suitable dimmers are chosen, these are a means to an end and not the end itself, since the color lighting effects depend upon what is done *with* the dimmers. Thus the operational means are most important and usually determine the effectiveness of the whole installation. This is particularly true of motorized color change lighting, since operator know-how is of little use when dimmer movements are set in a fixed sequence.

Basic Considerations

Some major factors that must be taken into account in planning a mobile color lighting system are:

Range of colors to be provided—The term "all the colors of the spectrum" is frequently used to imply all known colors—but this is a misnomer, since the spectrum concerns basic hues alone

and does not include pastel and neutral colors. Also important hues, including magenta and crimson, and known as the "purple group", are not seen in the spectrum. The basic hues to all colors are diagramatically indicated around the outer edge of the triangle in Fig. 1, and pastel tints are represented by an infinitude of points within the triangle. However, the number of different colors actually "seen" in a mobile color lighting installation, depends upon many factors in addition to color blending. Chief among these is color contrast and eye adaptation. Without some form of contrast, the range of resultant colors will appear to be limited, since the conditioning of the eye by one color determines to a considerable extent what is "seen" for another color. Thus color range is dependent upon design of color sequences and contrasts.

Modulation of color saturation—Pastel colors or tints are obtained by desaturating color mixtures, and this means the simultaneous use of all three primaries in a three-color red, green, and blue system, or the addition of white light to a color mixture in a four-color red, green, blue, and white system. There are a much greater number of pastel colors than deep colors and a color sequence should normally include some selected tints.

Intensity variation—It is sometimes necessary to vary the illumination intensity of a color mixture *without changing its color appearance*—or to directly change to another color mixture at a different intensity.

Identification of colors—Since there are an almost unlimited number of possible color mixtures, every hue and tint of value should be identified by a name or number.

Selection and reproduction of colors—It should be possible to select any desired color and reproduce it at any time with precision. Means may be required to select and set up a number of required colors—either in a fixed sequence or in any desired order.

Flexibility of changes — When means of selection are available, it should be possible to merge directly from one selected color into another, without passing through unrelated colors. It may be desired to either switch or merge into the next selected color. Overall intensity may be required to vary during the actual process of color change.

Simple Flexible Controls Needed

Thus the operational means for moving brightness controls may vary considerably according to the lighting requirements, but there is one requirement common to all of them—simplicity of final control. Many clever control installations are virtually valueless because the control panel and adjustments are almost unoperable under prevailing circumstances. There is apt to be a difference in control know-how between a specialist mobile color designer and an engineer-operator, and elaborate control features may defeat their purpose. Motorized control systems that constantly repeat a fixed sequence of color changes do not cause these difficulties, but the possibilities of the lighting system are greatly reduced when the choice and sequence of colors cannot be changed as desired from time to time. Thus operational means should be designed to provide maximum range and choice of lighting results with a minimum of control knobs and adjustments—and furthermore should unmistakably indicate the color possibilities of the installation, *even to the uninitiated*.

Motorized Dimmers

A popular way of controlling mobile color lighting is by means of motorized cycle dimmer equipment. This provides a constantly repeating cycle of color changes that are usually made up from pairs of the "primary" colors of a three-color system. Considerable use has been made of cycle dimmer equipment embodying one dimmer for each "primary" color, arranged with the dimmers in either a fixed or adjustable relationship. Non-adjustable multi-dimmer equipment may employ specially designed unidirectional dimmers mounted on a common operating shaft; or alternatively, standard type dimmers may be operated by cams. By using adjustable cams, the relationship of the dimmer movements may be re-adjusted within certain limits.

Many non-adjustable cycle dimmer equipments only provide a simple range of deep colors without any pastel tints, and even some adjustable systems do not provide any great choice in this respect. Thus there is apt to be a loss of potential color effect with many cycle dimmer systems, due to inability to fully utilize the factor of "successive contrast". The blending of the "primary" colors in different proportions produces a range of resultant effects, but it is difficult to fully appreciate the differences of closely related hues unless these are separated by suitably contrasted colors.

Special Control Systems

Color sequence principles are sometimes embodied in special control systems that feature a color mixture indicator, so that a controller may be set at the exact position required to obtain a specific color effect. With four-color systems, means may also be provided to vary the saturation of some or all of the colors in a sequence.

Color contrast relationships between different sets of lighting equipment are sometimes more easily arranged when there are separate controllers rather than one large control unit for them all, although special switch and/or patch panel arrangements can provide considerable flexibility in conjunction with one set of variable-load type dimmers. Elaborate mobile color installations are sometimes controlled by a number of separate motor-operated dimmer units, that are controlled in movement by means of control circuits from associated switch mechanisms. Various sections of the lighting installation can then be related to each other in different pre-determined ways.

When mobile color lighting control apparatus enables the choice and order of colors in contrasted sequences to be selected from a wide range of hues and tints, and varied as required, then it is possible to make proper use of the factors of successive and simultaneous contrast; and when this is done the lighting effects will be outstanding.

With increased emphasis being placed on commercial and industrial lighting, it is only natural that renewed interest will be shown in elaborate and dramatic lighting for stores, restaurants, night clubs, theatres and places of recreation and amusement. We believe that **mobile color lighting** will be the medium used to provide much of this lighting. A few spot installations are already being made across the country. We also believe that lack of knowledge of the fundamental principles of mobile color lighting is one of the main stumbling blocks to its increased use today. For these reasons, we asked Rollo Gillespie Williams, an outstanding international authority on this subject, to outline some of the principles of color blending, and of mobile color lighting techniques and controls, for the guidance of our readers who may be planning and designing such lighting systems. The accompanying article, prepared exclusively for **EC&M,** provides invaluable information on this subject.

Editor

Common Code Problems

Selected Code questions of wide industry interest discussed in detail

- **5 and 25 foot tap rule**
- **Apartment service conductors**
- **Grounding**

by B. A. McDonald

5 and 25

The inquiry concerns a proposed residential service entrance planned as shown in Fig. 1. The main switch is to be fed by 3/0 conductors which are then extended to an adjacent double throw switch (providing for emergency throw-over to an isolated generator). From the switch terminals two feeders are to be run, each 1/0 RH conductors in 1½ in. conduit, to 1) an adjacent 20 circuit panel and 2) a 14 circuit panel on the floor above, a distance of 5 ft. 8 in. Is such a plan acceptable under Code rules, or must additional overcurrent protection be provided?

The focus of the problem is the connection of the two 1/0 feeders to the 3/0 main feeder without overcurrent protection.

Section 2434 c and d recognizes such connections when their provisions are satisfied. These rules are commonly known as the 5 foot and the 25 foot tap rules.

The 5 foot rule requires the tap to have a current carrying capacity of not less than the sum of the allowable current carrying capacities of the conductors of the circuits supplied. In other words if the tap is not over 5 feet long and is large enough to carry the full rating of all of the circuits in the panel it feeds it may be connected directly to a larger feeder.

The 25 foot rule permits the connection of a smaller conductor directly to a larger conductor when 1) the

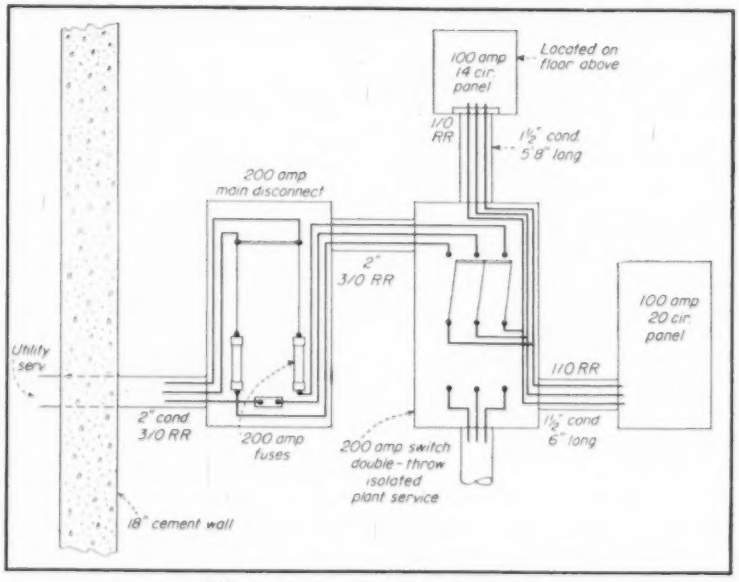


FIG. 1—Residential service connection.

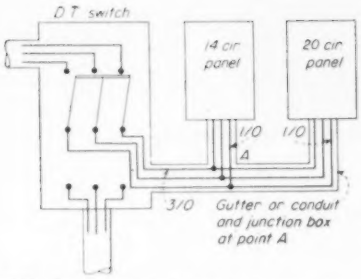


FIG. 2—Eliminating tap in switch box.

smaller tap is 25 feet long or less 2) the tap has a capacity of at least 1/3 of the larger conductor and 3) the tap termination at a single set of overcurrent devices which will limit the load to its rated capacity.

Applying these rules to your problem we find:

1) The 20 circuit panel tap appears to be less than 5 feet long, thus within the scope of either rule. If it consists of twenty 15 ampere circuits, ten on each side of the 3 wire feeder, the tap (5 ft. rule) must have a capacity of 10 x 15 amperes or 150 amperes. This is the rated capacity of 1/0 RH conductor so this tap would satisfy Code requirements.

If, however, some of the circuits are 20 amperes or more the sum of their capacities would exceed the capacity of the tap and would not satisfy the 5 foot rule. The 25 foot rule would be satisfied if overcurrent protection for 150 amperes or less were provided in the panel mains.

2) The 14 circuit panel tap is longer than 5 feet, consequently the 5 foot rule cannot apply. The 25 foot rule can be used to satisfy the Code requirements providing that the tap terminates at a single set of overcurrent protective devices (a main fuse or circuit breaker) at or in the panelboard of the required size (for 1/0 RH, 150 amperes).

Under the 25 foot rule smaller conductors would be permissable (though not necessarily desirable). The 3/0 RH main has a capacity of 200 amperes, one third is 67 amperes which would give the minimum size of the tap or No. 4 conductor. The maximum size of the overcurrent protection at the end of the tap, however, would have to be chosen to protect the conductor used.

There appears to be a violation of Section 3737 b in connections shown within the double throw switch. This section does not permit the use of switch enclosures as junction boxes. Figure 2 illustrates one method of correcting this.

In summary, the tap to the 20 circuit panel is proper, provided that the branch circuit conductors are not larger than No. 14. The tap to the 14 circuit panel must terminate in a single set of fuses or circuit breaker. The taps must not be made inside of the switch enclosure.

Apartment Services

The inquiry refers to accompanying Fig. 3 showing a service connection to 4 apartments. From a service drop (A), No. 6 S. E. cable is run to a 50 amp main circuit breaker (B) on the outside wall. No. 6 S. E. cable is extended from the main circuit breaker up to the eaves and along the outside wall to the splice boxes (C, D, E, F). At the splice boxes, No. 6 S. E. cable taps drop to the outside meters as shown. For the last apartment the connection from the splice box to the meter is No. 8. For each apartment, 3 No. 8 conductors connect the meter to a 3 circuit panel inside the building.

There are two questions about this installation. 1) Are there Code violations in the design and 2) may the meter enclosures and apartment panels be grounded to the service cable neutral conductor?

From the illustration it appears that the *service entrance conductors*, as they are defined in the Code, terminate at the 50 ampere service entrance equipment located on the outside wall of the building.

From that point on, the rules in Article 230 pertaining to services do not apply. The work beyond the service entrance equipment must comply with other pertinent Code rules.

The first point that could be raised concerns the use of service entrance cable without individual insulation on the grounded conductor, beyond the service equipment. Article 338 of the Code limits the use of S. E. cable to service entrance conductors, with the exceptions for interior wiring use as covered by Section 3382. It is quite possible, however, that a liberal interpretation of this Section would permit the use of the S. E. cable as shown. There could, however, in my opinion, be an argument on this point.

The size of the feeder running from the 50 amp. service circuit breaker would be governed by the requirements of Section 2201 of the Code, which recognizes a minimum 3 wire feeder, No. 10 in size, when the feeder supplies more than two wire branch circuits, provided of course, it would be of sufficient size for the load served and it would be properly protected.

In the case presented, this feeder is protected by 50 amp. circuit breaker and the minimum size of conductors would be No. 6. The No. 8 taps at the meters would be a Code violation unless they satisfied the 25 ft. or the 5 ft. tap rules covered by Section 2434-c-d of the Code. Since these taps do not terminate in a single circuit-breaker or fuse, the 25 ft. tap rule could not be used. If the taps were not over 5 ft. long, they could be No. 8 in size for the load you have indicated. It therefore appears that the No. 8 tap shown at point F, Apt. No. 4, would be a Code violation and the other No. 8 taps at the meters, if they exceeded 5 ft. would also be in violation of the Code. If these conditions prevail, it would be necessary on

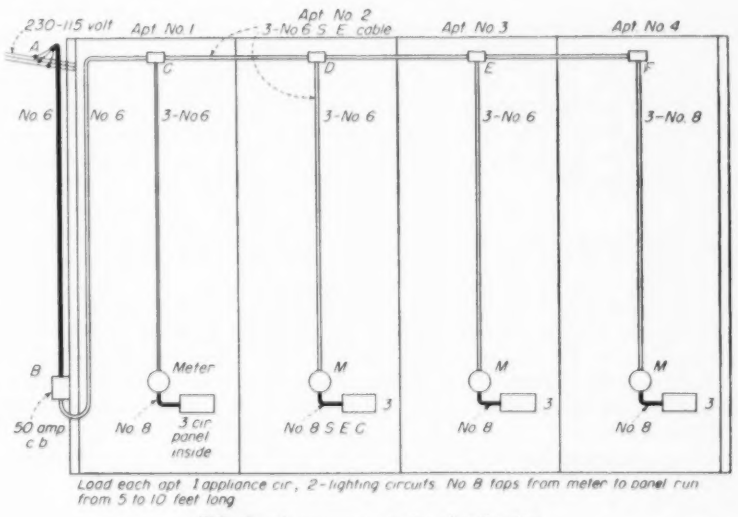


FIG. 3—Apartment service distribution.

this design to run the No. 6 conductors to each panel.

Section 2561 of the Code prohibits in general, the grounding of equipment on the load side of the service equipment, to the grounded circuit conductor. It would therefore be necessary to use a separate equipment ground conductor as covered by Section 2592 of the Code.

The problem which you have presented clearly raises an issue concerning the Code rules involved and indicates a possible need for change. In the case where the main circuit breaker is installed, as shown, we do have overcurrent protection on all of the conductors on the outside wall of the building and you do have a single means of disconnecting all wiring within the building. In a multiple occupancy building, the service conductors could have run along the outside of the building without the installation of a circuit breaker. This would result in the use of several hundred feet of unprotected conductors on the outside of the building and considerable service cable inside the building feeding the service equipment for each apartment. In the first case, you cannot ground the equipment to the grounded service conductor. In the second case, you may. In the first case, rules govern the overcurrent protection of the conductor beyond the main circuit breaker while in the second case, there are no rules for protecting the conductors. It is difficult for me to justify to you, from a standpoint of hazard, the inconsistency which appears evident when comparing the two cases. By installing the main circuit breaker, we do improve the safety of the installation. It therefore follows, if we wish to be consistent, that the conductors from the breaker to the panels should not be subjected to requirements greatly in excess of those prescribed when no main breaker is installed. This, I believe, is a question worthy of consideration by the Electrical Committee.

Grounding

The inquiry concerns grounding on an installation as shown in Fig. 4.

A water pipe ground is available in accordance with Code paragraph 2581.

Made electrodes are also available as defined in paragraph 2583c.

The specified vault ground bus is ¼ x 1 in. copper to four 8 ft. by ⅝ in. ground rods with transformers and neutrals connected to the bus with No. 4 bare copper. An "approved supplementary ground" to the water system was also required but no size specified. The secondary bus consists of two 500 MCM per phase.

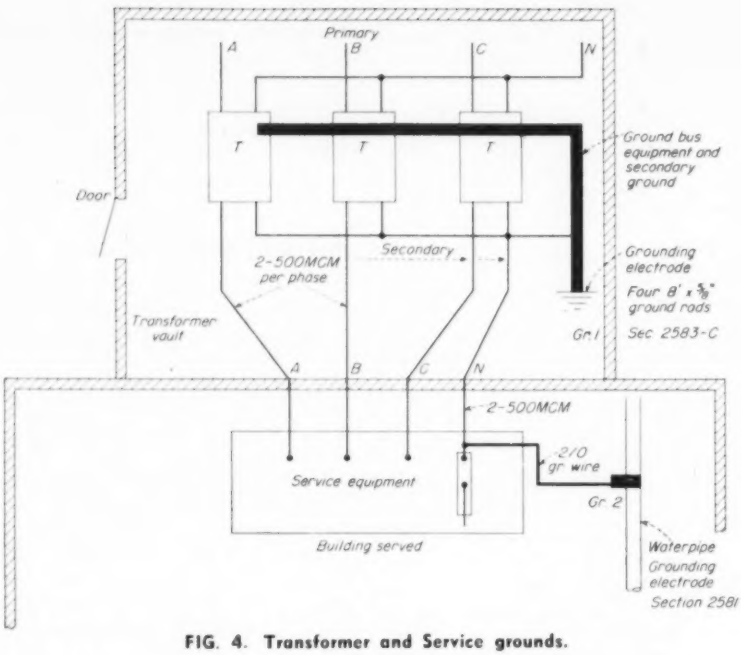


FIG. 4. Transformer and Service grounds.

Section 2523 of the Code requires alternating current circuits which are to be grounded to have a connection to a grounding electrode at each individual service on the supply side of the service disconnecting means. It also requires each secondary distribution system which is grounded to have at least one additional connection to a grounding electrode at the transformer or elsewhere. Section 2581 requires a metallic underground water pipe electrode if one is available.

Section 2594-a of the Code covers the size of the system grounding conductor or a common grounding conductor with a table which specifies minimum size grounding conductors which vary in size according to the size of the largest service conductor. Since the service conductor in question is equivalent in size to a 1,000,000 CM conductor, the minimum grounding conductor required is 2/0.

Section 7171 (over 600 volts) requires all non-current-carrying parts of equipment or apparatus to be grounded if installed in a vault not under the sole control of the supply company.

Application of these rules indicate to me, in the case in question, that the first requirement to be satisfied is the ground at the service equipment. This ground must be made to the water pipe and the grounding conductor must be at least two naught in size. The next requirement to be satisfied concerns the additional ground required by Section 2523 and the transformer vault equipment which must be grounded.

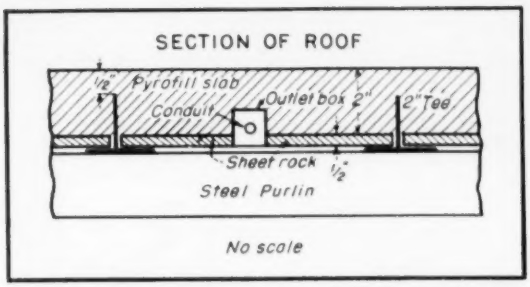
It is my opinion in so far as the secondary ground is concerned, that the principal ground is the one at the service equipment connected to the water pipe and the supplementary or rather additional ground is the one connected at the transformers.

The fact that a No. 4 bare conductor, or even a No. 6 conductor is recognized by the Code when "made electrodes" are used, should not be the basis of comparison with a water pipe electrode. Section 2584 points out the difference of the resistance to ground in each case and justifies the maximum size No. 6 conductor required for made electrodes. One of the objectives to be attained by grounding is expressed in Section 2551 which, in part, tells us that the impedance of the path to ground shall be sufficiently low to limit the potential above ground and to facilitate the operation of overcurrent devices. In order to satisfy this fundamental rule we must not lower the minimum size conductors required by the table in Section 2594-a.

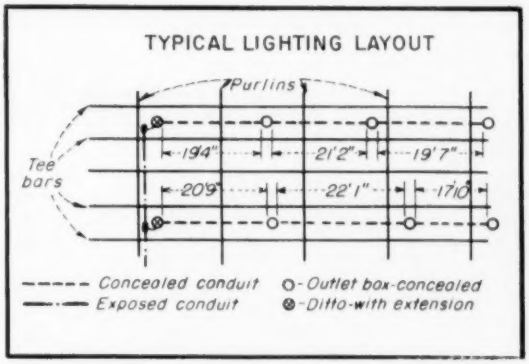
I believe that the Code requires a 2/0 grounding conductor under the conditions shown.

How Construction Techniques Affect Estimating

By John P. Reynolds



TYPICAL ROOF SECTION shows the roughing-in problem.



PRELIMINARY lighting layout disclosed the opportunity to use prepared box and EMT assemblies to minimize work.

New building construction materials and techniques may require special methods of electrical installation before an estimate can be prepared.

WITH the many new construction features encountered today the electrical estimator must be prepared to devise special installation methods before he can finish an estimate.

This circumstance can be a headache or an advantage, depending on the nature of the work and the type of competition. It's no satisfaction to know the successful bidder missed a hidden labor item that you discovered. On the other hand, a saving which is apparent only after a detailed study can give the meticulous estimator a substantial edge.

An unusual demonstration of both these situations was encountered by the A. S. Reynolds Electric Co., Brooklyn, N. Y., in bidding on the Associated Food Stores warehouse and office building, Jamaica, N. Y.

The significant structural feature of this job was the roof of the 120,000 sq. ft. warehouse area. This was to be a 2 in. slab of U. S. Gypsum *Pyrofill* poured on ½ in. sheetrock forms which rested on the flanges of 2-in. tee bars tracks spaced two feet apart. Steel purlins, averaging seven feet between centers, supported the tees. Ceiling height was 21 feet.

If the conduit could not be installed in the slab, a substantial increase in cost would occur for these reasons:

1. Heavywall conduit would be needed since the only possible support for fixtures would be the pipe itself.

2. Hanging conduit under the steel at a height of 21 feet would be extremely slow work.

This is the point at which one of the bidders stopped reasoning and started his takeoff. The Reynolds' estimator, however, soon discovered the flies in this simple ointment.

First, there was less than a half inch of clearance between the top of the tee bar and the top of the slab. Therefore, all lateral conduit runs—these, incidentally, were the home runs only—had to be exposed.

Another deterrent was that the slab was to be poured at a rate of 20,000 sq. ft. per day and, moreover, the sheet rock forms would be laid within two or three hours of the pour to avoid damage from dampness. Since the electricians would be afforded no safe footing even when the forms and accompanying wire mesh had been put down, it seemed unlikely that a small crew could place 50 outlets and over one thousand feet of tubing in a day.

It was decided that although the home runs had to be exposed, they could be installed in EMT if supported every five to six feet on trapeze hangers. The lighting branches would be concealed by the following methods:

1. Outlet locations would be laid out by the engineer on an overlay of the steel framing plan.

2. Octagon boxes with exact length of EMT to connect to the next outlet would be assembled on the ground.

3. Each box with attached conduit would then be laid out on the roof steel adjacent to its ultimate location.

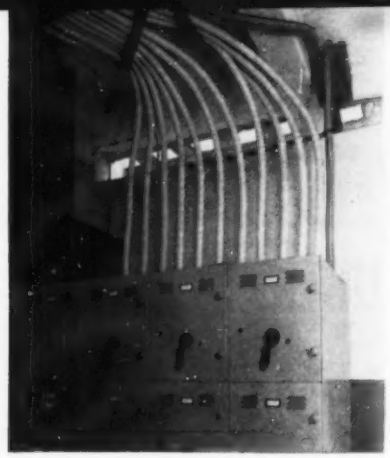
4. As the sheetrock was put down, the electrician would cut a 4-in. hole and connect box to conduit from the preceding outlet.

5. Connections between home runs and branches would be made by use of extension rings on the boxes.

On this basis it was estimated that a saving of about $5,000 could be accomplished against the cost of doing the work completely exposed.

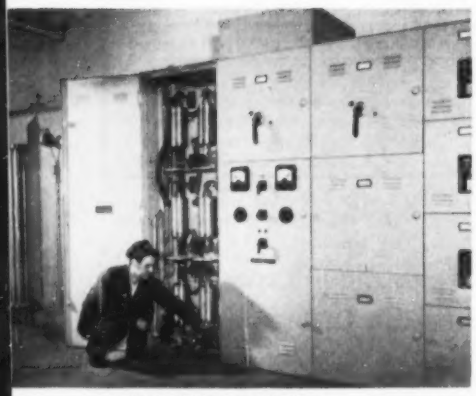
The results of the bidding bear out the story. A. S. Reynolds Electric Co. was second and the job was awarded to the low bidder. Before work started, however, the low man reneged and the Reynolds firm was signed.

Modern trends and practices in . . .

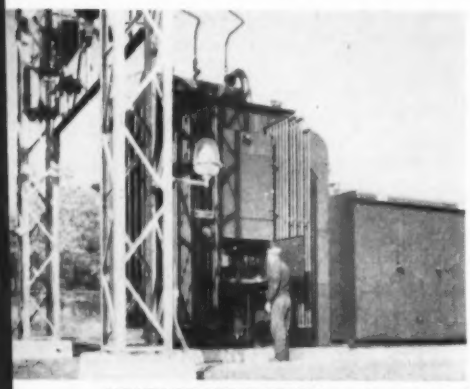


INTERLOCKED ARMOR CABLE in racks is readily installed, easily shifted, is accessible for visual inspection at all times and may be spliced with the use of simple mechanical methods that eliminate lead wipes.

Industrial Power Distribution—2



LOW-COST DC POWER may be obtained through the use of sealed ignitron mercury-arc rectifiers, close-coupled with transformer and switchgear sections.



VOLTAGE REGULATION can be obtained by installing load-ratio controls at the points of primary transformation where utility service at the 15-kv-plus level is stepped to plant distribution values.

Maintenance of power continuity, reduction of installation and operating costs, protection of personnel and equipment, and efficient system planning can be materially aided by using load-center distribution, economical unit substations, proper circuit arrangements, higher distribution voltages, grounded neutral systems, interlocked armor cable, plug-in busways, rectifiers, capacitors, voltage regulation and low-voltage relay switching.*

TODAY'S progressive industrial plants are rarely static. As product designs are altered, public demand for assorted goods fluctuates or as operational sequences are varied, manufacturing plants must rearrange production equipment, shift electrical load centers, modernize, revamp or expand their physical facilities. Even though many of these changes are minor or infrequent, the possibility of having to make fast major revisions must be anticipated. If changes are to be made with minimum down time, minimum disruption to production and minimum expense, a flexible electrical distribution system is a must. This means that a modern industrial distribution system should be designed for easy expansion, modification, rerouting or salvage.

ENCLOSED BUSWAYS

For these reasons, various types of enclosed busbar systems are now in widespread use, such as (1) low-voltage-drop ventilated busways with current ratings from 600 to 4000 amperes in 2-, 3- or 4-pole construction for feeder service, (2) 2- and 3-pole plug-in busways suitable for 120/208 or 277/480-volt service, and (3) trolley busways to serve small cranes, portable tools or large area lighting installations. These systems provide maximum flexibility in machine arrangement without the cost or nuisance of rewiring each time a machine layout is altered. Even when major changeovers require the moving of entire departments, these busduct systems can be quickly dismantled and shifted with practically 100% salvageability.

ARMORED CABLE

Many large industrial plants are likewise recognizing the advantages of interlocked armor cable. This is a self-contained flexible wiring system with conductors spaced and insulated by a heat-resisting varnished-cambric sheathing. Good mechanical protection is provided by the armored sheath which also provides protection to adjacent cables in the event of insulation failure and resultant arcing.

Simple mechanical methods of splicing and terminating have been developed which eliminate the need for lead wipes. When these interlocked armor cables are supported by open racks or trapeze hangers, they are

** This timely review of distribution ideas is based upon the slide film titled "The Vital Link"—the most recent in General Electric's "More Power to America" series.*

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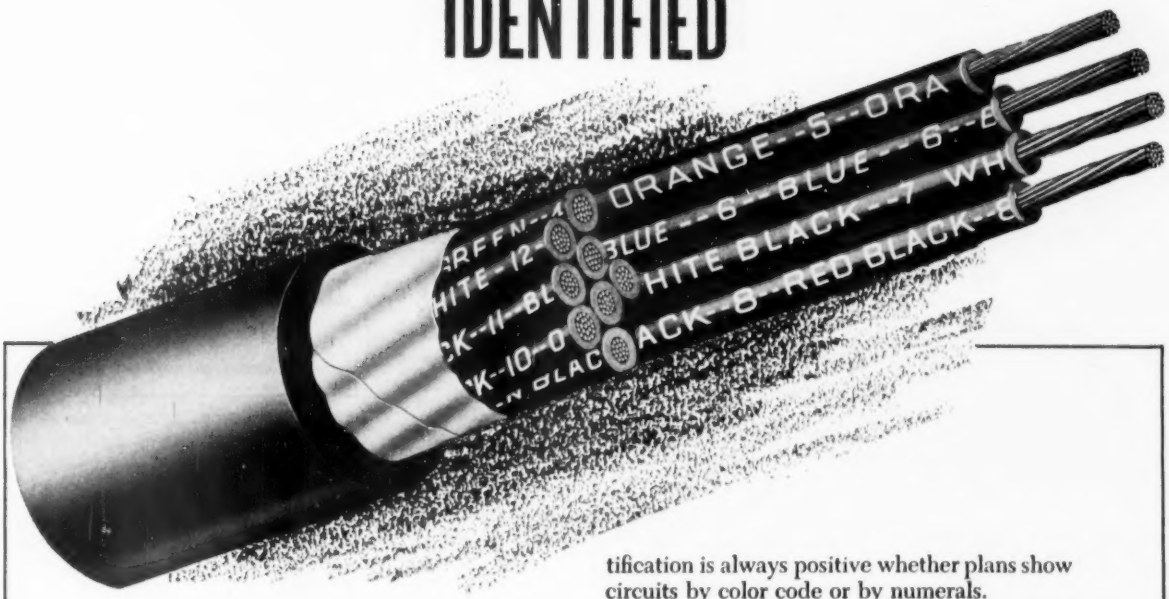

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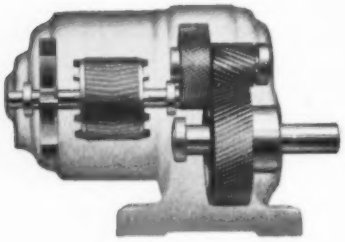

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readily accessible for visual inspection or on-the-spot work. Installation for long continuous runs is fast and easy, and the ability to make numerous right-angle bends is another advantage.

As to current-carrying capacities, it has been found that a 350 MCM interlocked armor cable will safely carry as much current as a 500MCM RH rubber-insulated cable in conduit. This adds up to savings in both time and money, often amounting to as much as 40% in installation charges.

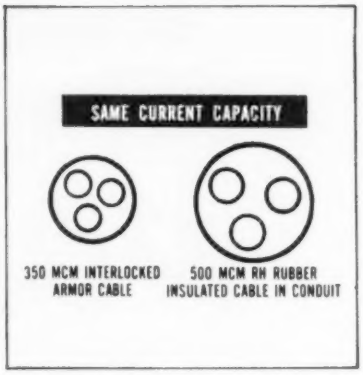
RECTIFIERS FOR DC

When direct current is essential for partial plant operation, it is most economical to install an ac load-center distribution system as previously described, then adding a mercury arc ignitron tube dc load-center unit sub where it is needed. Sealed tube and pumpless tank rectifiers are close-coupled with the transformer and switchgear sections, eliminating expensive conduit, interconnections and interconnecting cable runs. In addition, since rectifiers are essentially static, heavy supporting foundations are not required. And not to be overlooked—they are only 25%-35% as expensive to install as conventional rotating equipment, such as synchronous motor-generator sets or converters.

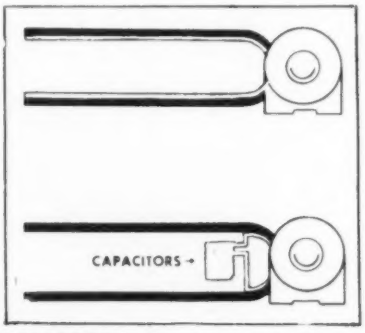
The biggest advantage of a mercury-arc rectifier is its high efficiency, remaining close to the 90% mark between 20% and 120% of full load. Over a period of time, this higher efficiency can result in appreciable savings. Still other advantages include an inherently lagging power factor between 87% and 90% (which can be improved by applying capacitors), and an economical water cooling system.

Rectifier maintenance, outside of the usual inspection which should be given any electrical equipment, is primarily a matter of tank servicing. They do not need an operator in attendance, they are clean and quiet and, since they are metal-enclosed, they may be located close to their load with maximum safety. For smaller dc loads, such as individual cranes, hoists, elevators or machine tools, or for the excitation of synchronous motors, metallic selenium rectifiers provide efficient means for spot conversion, and then the benefits of ac distribution and the special advantages of dc motors or other dc equipment are combined.

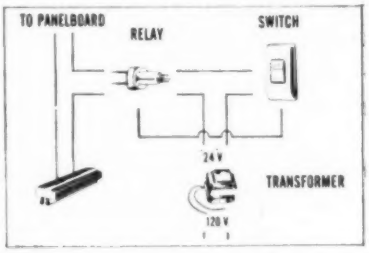
Metallic rectifiers are easy to install, may be moved into place quickly by a fork-lift truck and require no special foundations or bracings. Their life is conservatively rated at 60,000 hours of continuous operation at full load; they have an initial efficiency of 85%; maintenance costs are practically nil due to the absence of moving parts, and they may be easily relocated to fit changes in plant layout, or added as dc requirements change.



A 350MCM CABLE sheathed with interlocked armor will carry as much current as a 500MCM RH rubber-insulated cable in conduit.



CAPACITORS, when located close to an induction motor, provide magnetizing currents without raising the ampere loading on the main supply line. Since magnetizing kilovars do not produce useful horsepower, the use of capacitors to supply this need improves plant power factor.



LIGHTING LOADS at 277 volts may be safely controlled through the utilization of remote switches operating through relays. Control wiring is at 24 volts. Switches may be mounted wherever convenient and lighting may be controlled either from one or several positions.

CAPACITORS FOR PF

In most industrial plants the greater part of the electrical load is made up of induction motors. These motors re-

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Tips on TESTING . . .

Concerning Low Resistance Measurements of Cable and Conductor Joints

High-resistance joints in cables and conductors are a major source of trouble in electrical circuits, and one of the chief uses of the "Ducter" Low Resistance Ohmmeter is in combatting such conditions. High-resistance joints cause objectionable voltage drops, loss of power, and damage from localized heating.

A few mental excursions into Ohm's Law will reveal the fact that a small fraction of an ohm in high-current circuits can equal an appreciable number of volts, and will result in lost kilowatts. Circuits normally having low resistances, say in the order of 11,000 microhms (.011 ohm), which is equivalent to about 1,000 feet of 1,000 mcm cable, could easily have defective joints that would double that value. If this cable is rated at 370 amp., the voltage drop would be 100% above normal, or a total of 8 volts, and would waste 36 kwhrs per 24-hour day above the normal loss.

Such defective joints can be discovered by evidences of heat, or by measuring the voltage drop during normal load periods. These methods are not as simple as measuring the cold resistance of the joints, either when they are installed or during off-load periods. Any well-made joint should have a resistance between the points measured not greater than the same length of the cable or conductor involved. This would mean, in the case of the 1,000 mcm cable previously mentioned, that any joint in its length within a space of one foot should not exceed 11 microhms (.000011 ohm). The "Ducter" Low Resistance Ohmmeter measures values down to 1 microhm (.000001 ohm).

Useful Formulas

The foregoing value of 11 microhms is determined as follows:

$R = \rho \frac{l}{a}$ where $\rho = 10.7$ ohms/cm. ft. at 20° for 97% conductivity copper. l = length in feet, a = area in circular mils.

$$R = \frac{10.7 \times 1}{1{,}000{,}000} = .0000107 = 10.7 \text{ microhms.}$$

This calculation is given here for convenience so that users may be reminded of the method of determining the resistance of any conductor. The following formulas will also be helpful.

Rectangular or square-shaped conductors:

$$\text{Circular mils} = \text{cm} = \frac{\text{sq. mils}}{.7854} = \frac{\text{in.}^2 \times 10^6}{.7854}$$

For round conductors:

$$\text{Circular mils} = \text{cm} = (\text{dia. in mils})^2$$

NOTE: The above material is taken from our Instruction Manual for use with the Ducter Low Resistance Ohmmeters. In it is valuable information including "Resistance Network Data", "Temperature Data" and many tables, diagrams and formulas to help those men concerned with low resistance measurement problems. We will be glad to send you a copy of this manual without obligation. Just write on your company letterhead for **MANUAL 24J-ECM**

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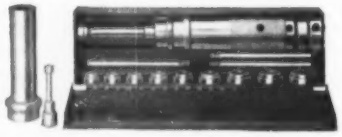
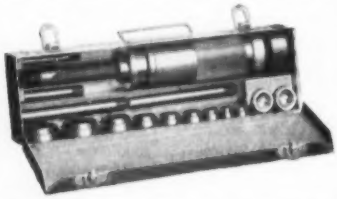
BEARING TOOL SETS



No. 1 Bearing Set above is used to insert or extract bearings from motors or other machines—Capacity ½" to 1 1/16". Set includes two bearing supports for different motor frames, 10 different taps and Fan Motor attachment for bearings less than ½".



No. 2 Bearing Tool Set above is heavy-duty unit for bearings or bushings from 25/64" to 1⅜" inside diameter. Consists of 3 bearing supports, 3 reducing studs and nine heads as shown in metal box.

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quire kilowatts to produce horsepower but, in addition, they require kilovars to produce magnetizing currents. These kilovars are necessary for the operation of the motor, yet they perform no useful work and, when drawn from the main supply line, they reduce the overall power factor of the plant.

By installing a capacitor close to this motor load it becomes possible to supply the necessary kilovars directly at the point of need. This reduces line current and makes it possible to add more electrical equipment to each feeder. This permits the addition of extra operating equipment without having to install extra distribution equipment.

It also eliminates the greater part of utility power factor or kva demand penalty clauses, resulting in savings that frequently pay for the capacitor installation in two years or less.

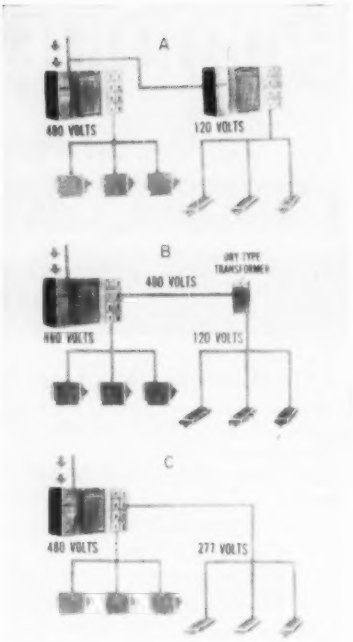
Capacitors also help to raise plant voltage levels, insuring rated output of motors, lighting fixtures and heating devices.

Since induction motors are the primary cause of low power factor, a convenient arrangement is to place the capacitors at motor terminals. No switching devices are required with this arrangement and the capacitors are automatically switched on or off with the motor. When a group of motors is connected to a common bus, a number of individual capacitor units may be connected to the bus, with separate switching devices provided for each unit. These switching devices may be magnetic air circuit breakers, thermal air circuit breakers or fusible units. Where highly repetitive operation is desired, an industrial type contactor is recommended. For large equipment the breaker or switch can be housed with the capacitors. For small capacitor equipment a separate wall-mounted air breaker of the enclosed type can be used.

RATED VOLTAGE

It is important to keep voltage where it belongs since something is sacrificed, either in life or performance, whenever the voltage at terminals of a utilization device varies from nameplate rating.

For example, with induction motors, undervoltage decreases starting torque and increases full load temperature rise, reducing the life of the insulation and, consequently, that of the motor itself. Conversely, overvoltage produces increased torque which can damage equipment, decreases power factor, and requires more starting current to be drawn, thereby increasing light flicker.



THREE BASIC SYSTEMS for supplying power for lighting loads include (A) a separate substation for power and lighting, (B) one substation with small dry-type transformers for lighting, and (C) a combined 480Y/277-volt installation with power at 480-volts 3-phase, and fluorescent and mercury lighting at 277-volts with circuits connected phase-to-neutral.

Both life and output of lamps are affected drastically by voltage changes. With incandescent lamps a 10% voltage drop produces a 30% output loss, while a 10% voltage rise cuts lamp life to less than a third. This triples replacement charges. Mercury lamps are affected similarly, while a 10% voltage drop will cut fluorescent output a like amount and will also shorten lamp life.

With resistance heating devices, heat output varies as the square of the impressed voltage. This means that undervoltage results in sharp drops in Btu output, and overvoltage may lead to a burned-out unit due to excessive heat.

Electronic equipment also depends upon maintained rated voltage for performance, since standard industrial tubes are designed to operate within a voltage tolerance of 5% plus or minus.

To control voltage at the main power source, some form of voltage regulation can be installed at the incoming transmission line, such as automatic tap changing devices incorporated with primary transformers, designed to operate under load. This is known as load-ratio control and, when installed,

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it permits both the utility and the industrial plant to operate their systems independently and to their own best advantage without interference with respect to voltage. It is recommended for installations where utility power is received at or above 15-kv.

Where power is supplied below the 15-kv level and is carried directly to load-center substations before being transformed to utilization voltage, separate voltage regulators should be installed in the primary supply if wide fluctuations are present. Since load-center systems generally have short secondary feeders and low voltage drops, further regulation is usually unnecessary. However, if the voltage spread is great, separately mounted air-cooled regulators may be installed in the feeders involved.

For secondary feeders serving such voltage-sensitive loads as furnaces and lights, inductrol power packs are recommended. These units are made up of induction voltage regulators and dry-type transformers rated 480- or 600-volts on the primary and either 208Y/120 or 120/240-volts on the secondary. A primary switching and protective device and a secondary distribution panel or terminals completes each package. The unit may be used for supplying regulated voltage for lighting or general power service. It is shipped complete, ready to install on the factory floor or on overhead platforms located near the top of a building column.

Reduction of flicker due to reciprocating motor-driven loads at welders often is a much more difficult problem to solve than reduction of voltage spread. One solution is to separate the flicker-producing load from the lighting or critical load. Another method is to use a voltage stabilizer. These stabilizers can maintain output voltage within 1% plus or minus, even though input voltage varies by 30%. They have no moving parts, no electronic tubes, are reliable and have long life spans.

COMBINED P-L SYSTEMS

Power for lighting loads can be supplied by any one of three basic systems. (1) Separate substations may be installed to furnish 480 volts for power; 120 volts for lighting. (2) Distribution can be at one level (480 volts) with small dry-type transformers installed when and where required for lower voltages. This reduces the number of main transformers, decreases the amount of low-voltage cable, and results in considerable savings over the first method. (3) Distribution can be

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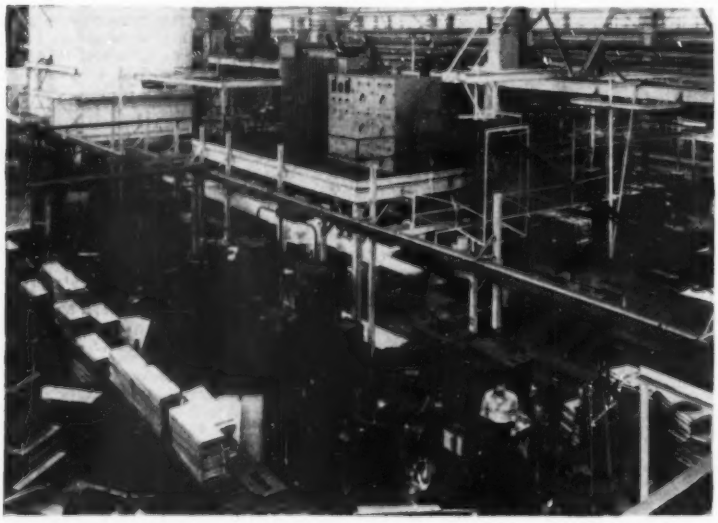
at 480Y/277-volts, with motors operated at 480-volts 3-phase, and fluorescent and mercury lights connected phase-to neutral with the total load divided between the three phases. Dry-type units provide incidental current for incandescent lighting and small tools.

Where industrial plants have a sizable office area, the 480Y/277-volt combined power-lighting system can result in savings up to 25%.

To operate these 277-volt lighting installations, remote control wiring combining 24-volt transformers and relays are ideal. Since all switches operate on isolated 24-volt control circuits rather than at 277 volts, the remote control system is considered safer. Switches can be mounted where most convenient and lights may be economically controlled from one or many switching positions. This installation is simple, saves copper, is both efficient and economical.



PLUG-IN BUSWAYS mounted above production floors provide power wherever required, yet leave the working area unobstructed. Platform-mounting of load-center substations accomplish the same objective.

ADEQUATE I-C

Since power equipment with inadequate interrupting capacity jeopardizes the safety of personnel and property alike, plant power systems should be carefully checked to determine the magnitude of all possible short-circuit currents, then circuit breakers with known adequate i-c should be installed.

In this connection, breakers are preferred over fuses for the protection of main circuits since they can safely open any current within their interrupting ratings, they eliminate the possibility of single phasing, can be adjusted to open at various combinations of time and current, can be used for repetitive operations and will not trip out on temporary faults. Fused switches in general are best suited to small branch circuit locations as the final protective device before a load. All small low-voltage fuses are current-limiting and operate faster than circuit breakers, thus limiting the flow of short-circuit current.

There is now available a complete line of short circuit protective equipment for service from the power source to the utilization device. Power circuit breakers can be obtained for circuits above 15-kv; metal-clad switchgear is recommended for circuits between 15- and 2.4-kv; drawout switchgear for unit substations and main buses, air circuit breakers and fused switches for branch circuits, are available for secondary systems of 600 volts or less and, for motor branch circuits, there are individual motor starters and motor control centers.

COMPETENT DATA

All of the foregoing practices and suggestions are based on long experience. They represent progressive trends in the industrial field and are based on actual design, installation, operating and maintenance experience gathered from all types of manufacturing and commercial operations ranging from large projects down to small factories and service shops requiring only a few kilowatts. Adoption of these ideas will assure power continuity, reduced installation and operating costs, and protection of personnel and equipment. They constitute the vital-link between utility supply and industrial production and provide operating conditions which have been found to be most beneficial to both.

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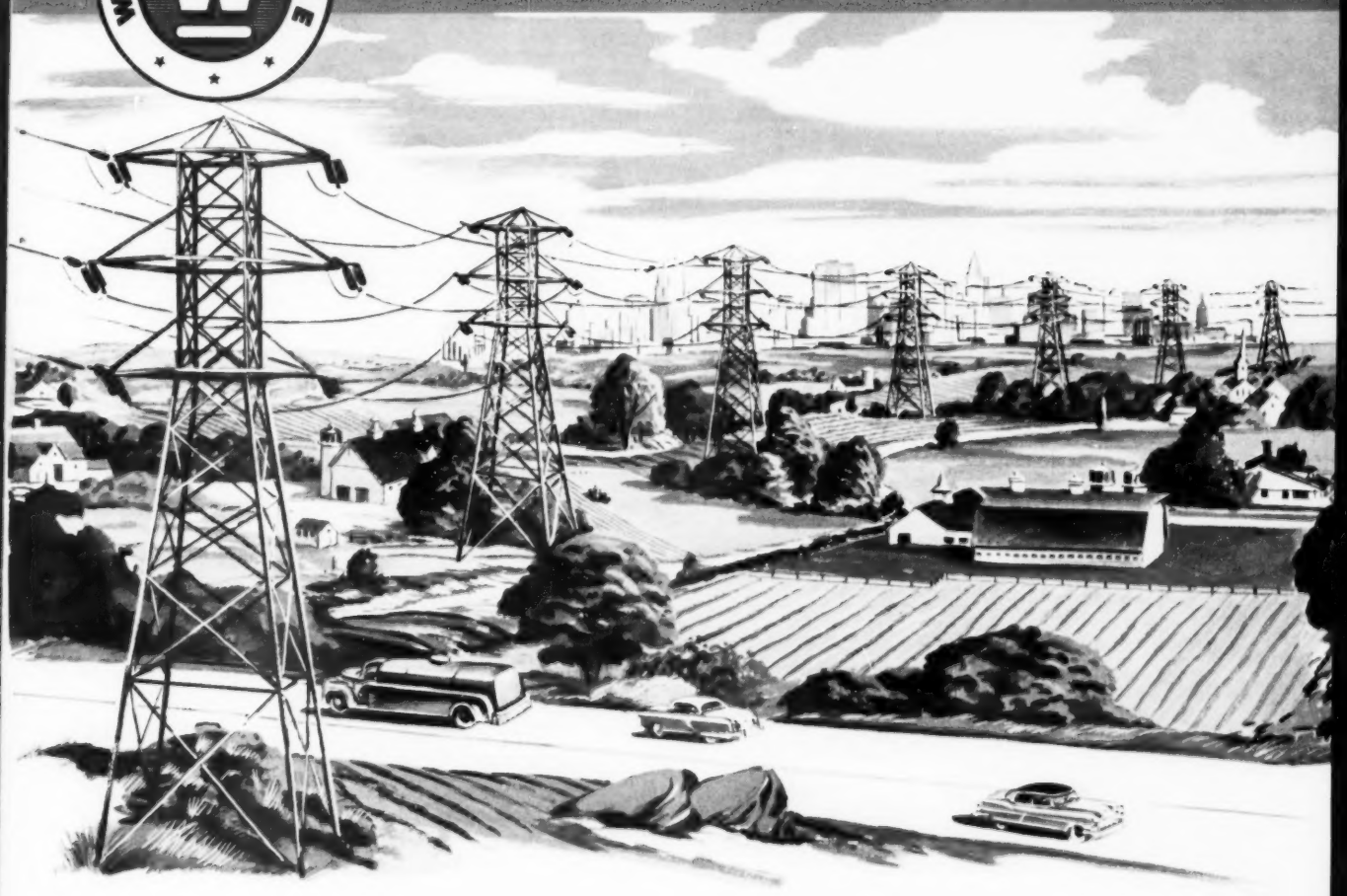

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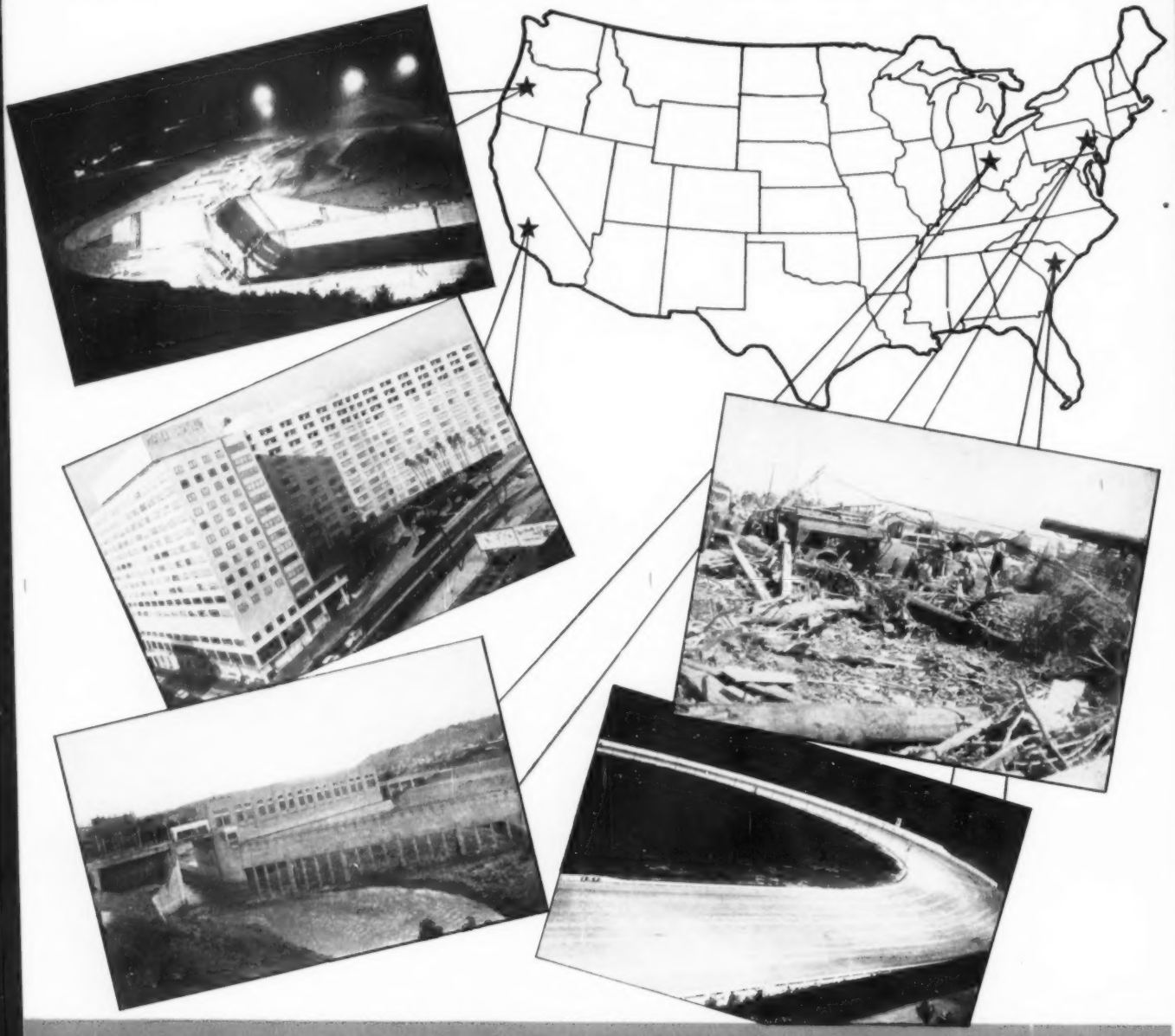

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Solon, Ohio – Expert engineering service and assistance from lighting specialists helped the Collier Construction Company land the floodlighting contract for the new Grandview Race Track. Wesco recommendations helped solve many intricate lighting problems.

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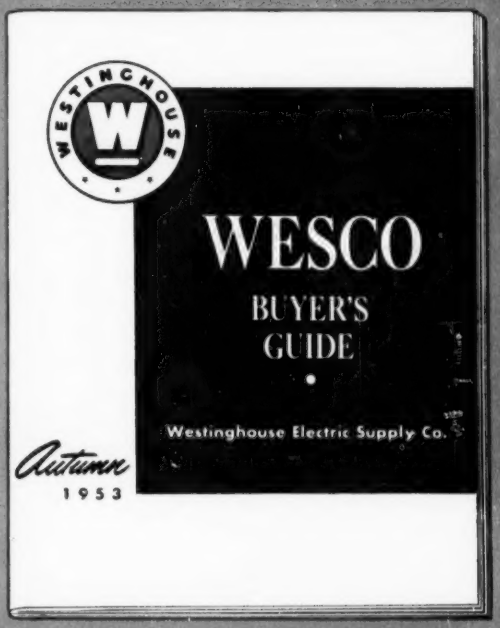

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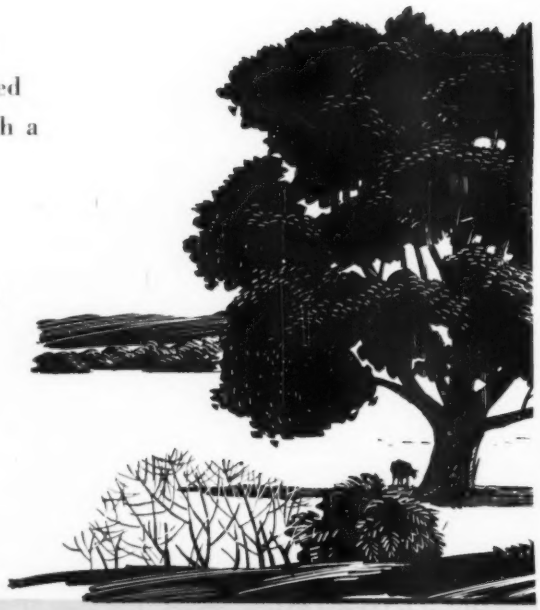

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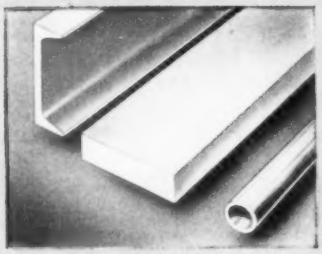
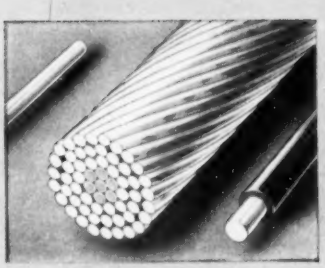
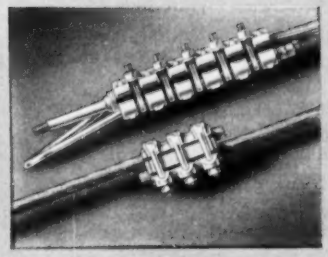
Accessories



Alcoa Aluminum Bus Conductors are available in rectangular and round bars, tubes and structural shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.

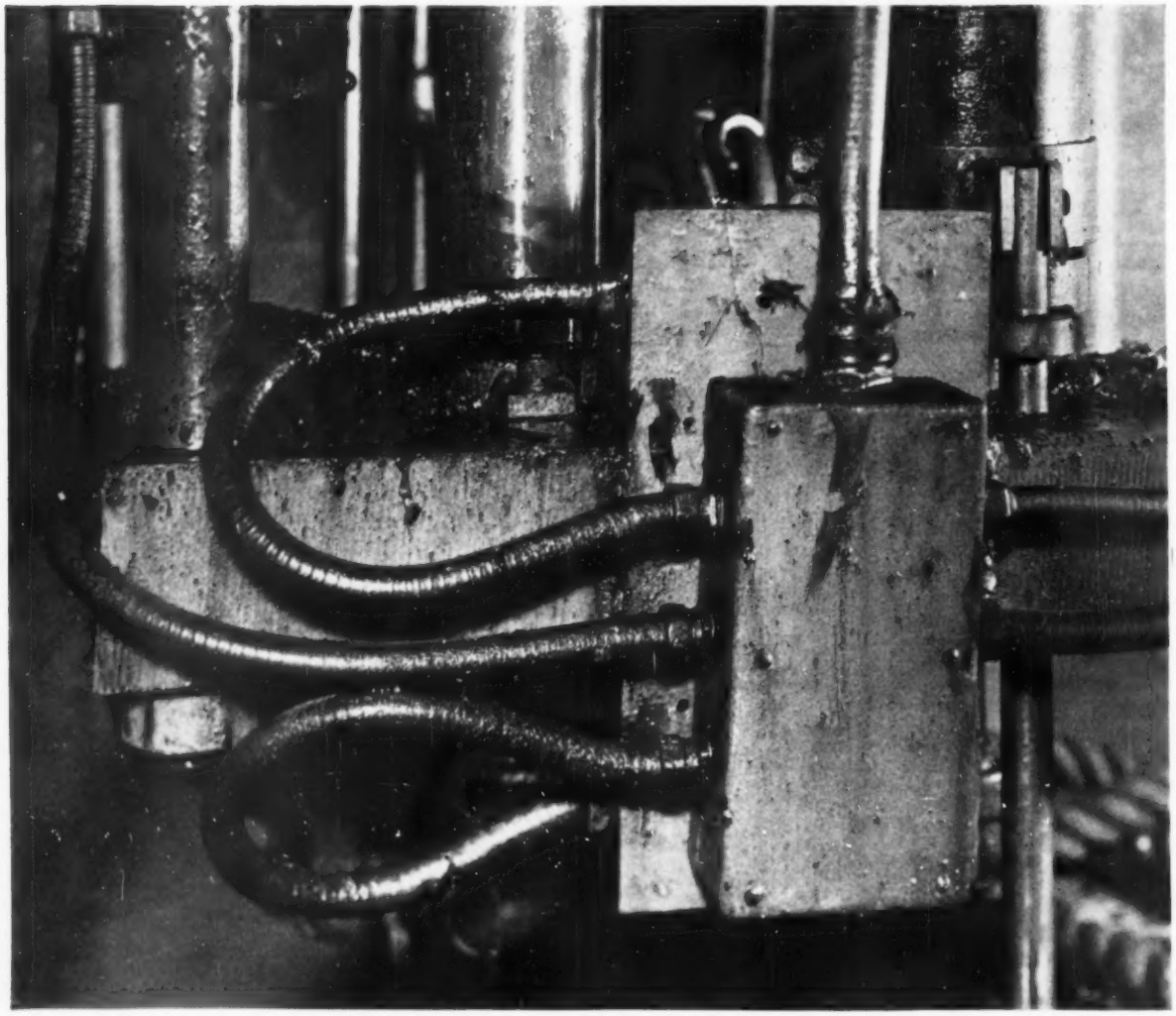


Alcoa offers aluminum accessories, correctly designed for use with aluminum conductors.

CALL WESCO

SEALTITE flexible conduit protects wiring against oil · grease · water · corrosive fumes · salt spray · and chemicals

Tough conditions for any wiring . . . but no tougher than protective SEALTITE



Keep foul-up and corrosion out of your lead-wiring

SEALTITE Electrical Wiring Conduit is flexible, liquid-tight and tough. So tough it resists all the enemies of motor lead-wiring mentioned above and many more. It absorbs vibration. It installs easily in cramped spaces. It hugs motor contours. It looks neat.

Sealtite* has been approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils (See N. E. Code, Art. 351)—the first conduit of its type to meet these rigid requirements. For tight bends and extra-flexibility on machine tools and industrial equipment, you may want SEALTITE Type EF (Extra Flexible), which meets standards set by J. I. C.

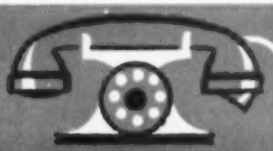
Electrical Supply Houses stock both types in coils. Buy it this way; then cut without waste. Jobbers also stock standard fittings. Write for Bulletin UA-530 to *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.*

*Trademark 53139

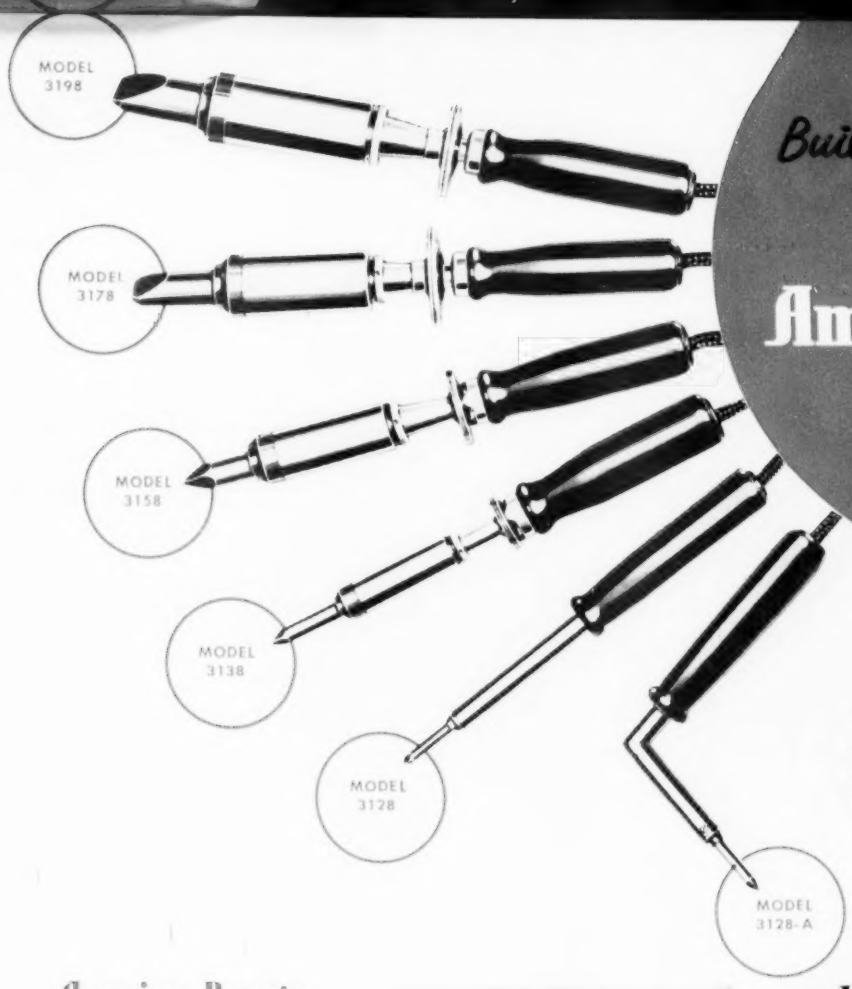
SEALTITE

flexible, liquid-tight electrical conduit

—an ANACONDA® Product



FOR EVERYTHING ELECTRICAL . .



Build better with Solder
Solder better with
American Beauty
Electric Soldering Irons

Six American Beauty models—from 60 to 550 watts—have set the soldering standards on the world's production lines since 1894!

you can't beat a soldered connection

for electrical conductivity and permanence. And American Beauty is first in sales, first in quality . . . because of these features . . .

- **Nickel-coated, corrosion-resistant tips, easily and quickly replaced**
- **Super-flexible cord, American Beauty-made, reduces worker fatigue**
- **Heating element of chrome-nickel ribbon resistance wire**
- **Insulated with pure mica**
- **Built-in connection for ground wire**
- **Six models . . . from 60 to 550 watts**

Write For Free Literature

American Beauty TEMPERATURE REGULATING STAND

Maintains soldering iron heats ranging from low to warm to full working temperature. Usable with irons up to 660 watts input. Can handle voltages up to 240. Can be equipped with a 3-conductor cord and receptacle at slight extra cost.

American Beauty tips . . . best in the industry!

Made from the purest drawn copper rod, to stand up under high heat for long periods of time.

TIPS ALWAYS AVAILABLE FROM STOCK

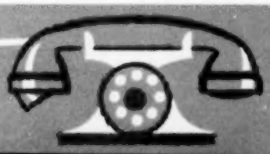
- Nickel-plated
- Iron-plated
- Eternalloy-clad

Eternalloy cladding multiplies many times the life of soldering iron tips. It is a patented process that electro-chemically deposits an alloy of metals on the tips. Specify Eternalloy . . . reduce your soldering costs.

AMERICAN ELECTRICAL HEATER COMPANY • 6110 CASS AVENUE • DETROIT 2, MICHIGAN

A-108

. . CALL WESCO



Electrically, it's Westinghouse in St. John's Hospital, Springfield, Missouri. Architect-engineers Marguolo & Quick worked closely with Westinghouse to design an electrical system that is both efficient and economical. Westinghouse equipment includes switchgear, bus duct, power centers and 89 De-ion Circuit Breaker Panelboards.

Don't take chances with your hospital jobs

Install Westinghouse Panelboards for maximum protection . . . lower job costs

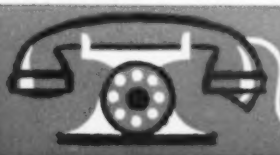
In hospitals, an element of safety depends on the circuit protection provided by panelboards. That's why contractors are turning to Westinghouse De-ion® Circuit Breaker Panelboards for hospitals and other jobs where long-lasting dependability is all important. Westinghouse Panelboards not only incorporate circuit breakers using the well-known de-ion principle, but other features of construction which provide life-long, trouble-free service.

There's a Westinghouse Panelboard for any circuit protection problem . . . in any type of building. Thirteen assembly plants give fast service and quick delivery throughout the country.

For the full story, call your Westinghouse Representative, or write for B-5260-A, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-93499-A

YOU CAN BE SURE... IF IT'S

Westinghouse



FOR EVERYTHING ELECTRICAL . .

Durasheath: for lower-cost power distribution

DURASHEATH* is a light, tough cable. It is easily installed and thoroughly dependable for series or multiple street lighting, traffic control, and airport† lighting, residential primaries and secondaries as well as for industrial plants and railroads. It may also be used as Type USE cable for underground service entrance.

DURASHEATH cable can save you money. You can run this flexible, easily handled cable underground (buried directly in the earth), overhead or in ducts (or in any combination of these) without needless, time-consuming jointing. Its light weight and flexibility make duct pulling fast even in zero weather. Aerial assemblies go faster. Linemen like to work with it.

* * *

As one of several types of ANACONDA power cables, DURASHEATH is available in all sizes, single or multiconductor, copper or aluminum, from 600 to 15,000 volts. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Reg. U. S. Pat. Off. 53311

†when ordered to CAA Specifications L-824

ANACONDA®

Primary and secondary distribution cables • building, machine tool, control and communication wire • portable cords and cables • bus-drop cables • apparatus cables • copper, aluminum, copperweld conductors • wire and cable accessories.

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ST Series
Liquid Tight Connectors

Malleable
Iron Unilets—
Form 35

Malleable Iron Unilets—
FS and FD Series

Outlet Boxes

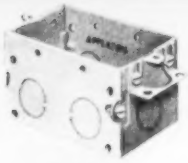
The Industry's Most Comprehensive

QUALITY LINE

— More Than 18,000 Items to Choose From —

Reelite
Automatic Extension Reels

Industrial Diskonect Reflector



Switch Boxes

V-51 Series
Vapor-Tight Fixtures

AA-51 Series
Explosion-Proof Fixtures

ALL from one source!

Whatever you need in the way of electrical fittings, malleable iron Unilets, lighting fixtures or roughing-in material . . . your most complete selection is from *Appleton.* And from a thread in the simplest fitting, to the machining of the copper collector rings on a Reelite, every stage of production is under the most rigid inspection to produce the utmost in quality.

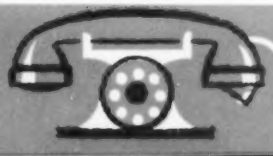
APPLETON

not only brings you your best quality line, but simplified stock control, standardized profit margins and satisfied customers. It's the line preferred by architects and contractors. Next time you replenish stocks, get *Appleton!*

Sold Through Electrical Wholesalers

APPLETON ELECTRIC PRODUCTS — REG. U.S. PAT. OFF.

APPLETON ELECTRIC COMPANY
1704 Wellington Avenue • Chicago 13, Illinois

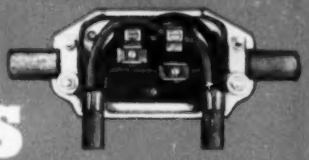


FOR EVERYTHING ELECTRICAL . . .

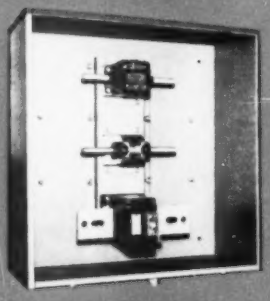
ANCHOR

METER MOUNTINGS and SPECIALTIES

Socket meter adapter for installation on existing bottom connected meter equipment.



Service Cable connection box for secondary distribution of multiple dwelling units.



New indoor C.T. cabinet for horizontal or vertical mounting. For standardized 600 volt and compact MR-1 RO-6A transformers.

Anchor Manufacturing Company has, for many years, specialized in the design and manufacture of meter mountings of all types to meet the steady increase in loads, and constantly changing requirements.

Anchor's shipshape and practical designs have led the way in many new methods of meter service installations.

Our engineering staff is available to assist on any meter service or meter testing problem.

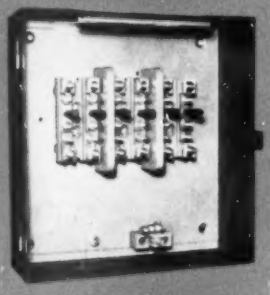
Heavy duty 200 Ampere socket for single or polyphase meters.

Outdoor (1 to 6 meters) horizontal or vertical. With or without conduit hubs up to 2½".

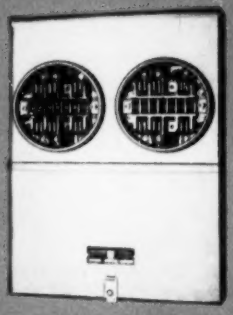
TRADE MARK REG.

ANCHOR MFG. CO.

MANCHESTER, New Hampshire

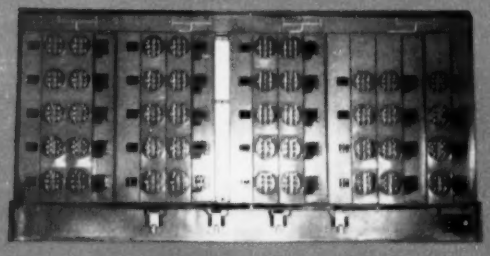


New indoor 600 volt, 150 Ampere meter test cabinet. (Cover removed).



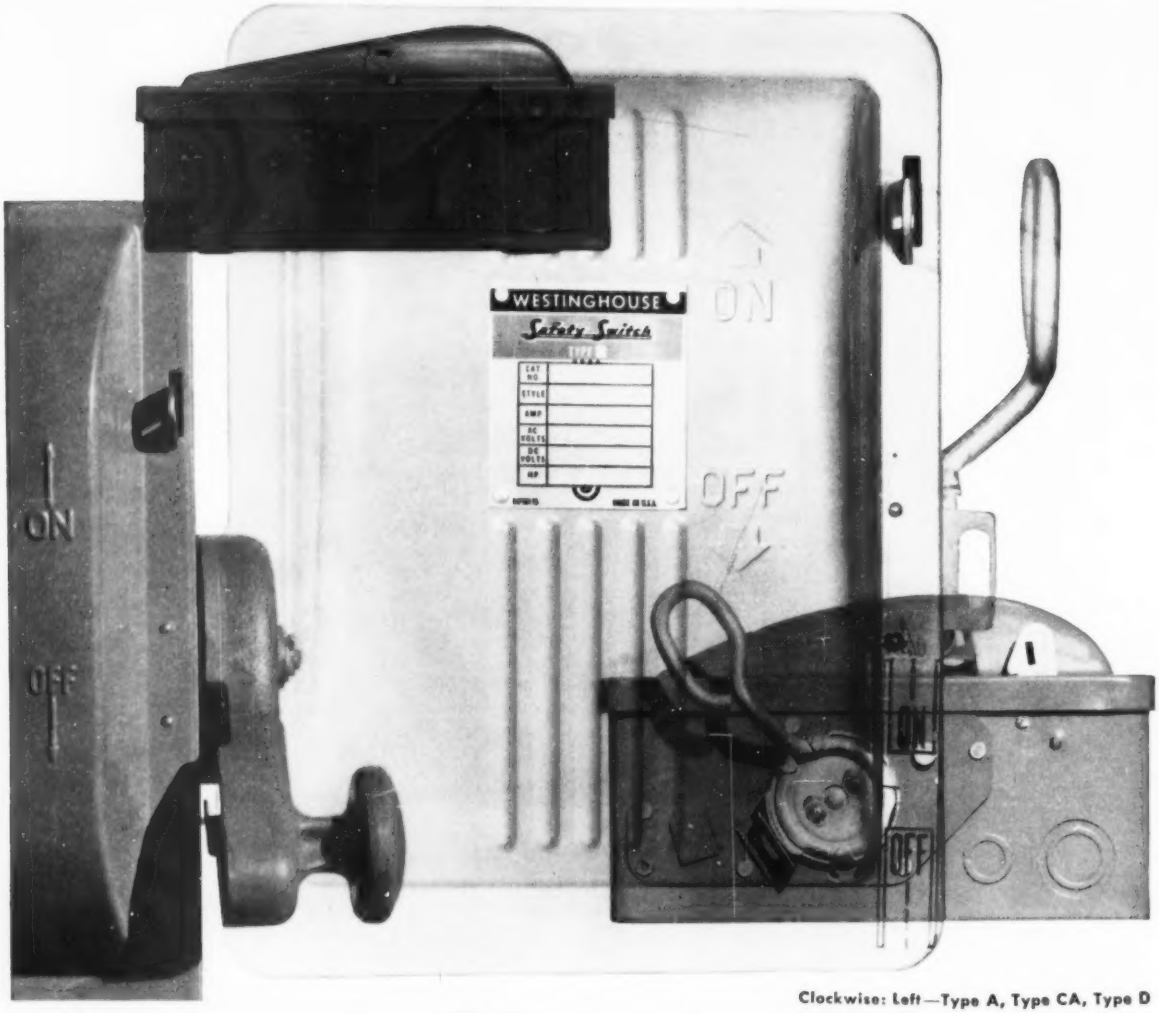
Duplex polyphase socket for KWH and VARH meters in series with Westinghouse phase-shifting transformers and bypass facilities. Factory wired and assembled.

Multiple polyphase meter sockets.



Meter channel for apartment projects combining sockets and Westinghouse circuit breakers. Covers of top and bottom gutters removed.

. . . CALL WESCO



Clockwise: Left—Type A, Type CA, Type D

3 full lines of *Life-Line** switches

give one standard of performance for any industrial or commercial requirement

You'll find only one standard of performance in Westinghouse A Switches—ruggedly built for rugged duty, and in the D Switch for light-duty general service. The CA, newest, most versatile member of the Westinghouse Safety Switch family, brings together in one great switch—and at conventional-type C Switch price levels—all the Westinghouse Switch values you've always relied upon.

For instance, exclusive diamond-pointed break jaw keeps arcing outside contact area, eliminates burning and beading, prolongs contact life. This is only one among many familiar and exclusive features of all Westinghouse Switches that will give you headache-free performance that can't be matched anywhere.

Drop in at your Westinghouse Distributor. See the new CA Switch. Look over the full line. Write for Booklet B-4723, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-30165

*Trade-Mark

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FOR EVERYTHING ELECTRICAL..

8 REASONS WHY BERMICO® FIBRE CONDUIT is your BEST CABLE PROTECTION

1. **WATERPROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.
2. **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.
3. **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!
4. **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.
5. **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.
6. **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.
7. **TIGHT.** All joints are precision milled for light, speedy, installations.
8. **EASILY HANDLED.** So light in weight that one man can carry several 8-foot lengths at once—lay more per working hour.

Production facilities and schedules are geared to assure prompt shipments

Distributed by

WESTINGHOUSE ELECTRIC SUPPLY COMPANY

Offices in all leading cities

For best cable protection, be sure to specify

BERMICO FIBRE CONDUIT — A PRODUCT OF BROWN COMPANY

Mills—Berlin, N. H.

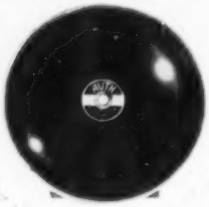
For Competitive Prices—Call WESCO—for Quality Electrical Supplies and Service

. . . CALL **WESCO**

SINCE 1892

AUTH

Complete Signaling Systems from One Responsible Source



Complete Systems for Hospitals

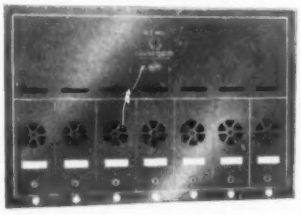
Nurse's Call, Vokalcall (Audio-Visual), Doctors' In & Out, Doctors' Paging, Fire Alarm, Synchronous Clock, Intercom Telephone, and Return Call (For Nurses' Home). Also night lights.

Complete Systems for Schools

Clock and Program Bell, Fire Alarm, Intercom Telephone, and Miscellaneous.

Complete Systems for Industry

Bell, Intercom Telephone, Fire Alarm, Annunciator, and Synchronous Clock.



Complete Systems for Housing

Apartment Telephone and Flush Bell. Also Apartment Mail Boxes and Non-Electric Door Chimes.

Electrical signaling systems usually consist of a number of different components which, when electrically connected, form a complete operating system. For example, Clock and Program Bell Systems for schools often comprise a program time instrument, a central clock-resetting device, a manually-operated cross-connecting bell control board, indoor and outdoor audible signals such as bells, buzzers and horns, and dual-motored clocks of various styles. The Fire Alarm and Intercommunicating Telephone Systems for schools are just as diverse in their components.

Likewise, the signaling systems which comprise the nerve centers of hospitals, housing projects, industrial plants and commercial establishments all consist of many different components electrically connected to perform their necessary, and often vital, functions.

The importance of securing all components of a system from one responsible source is obvious. To the architect, engineer, distributor and electrical contractor it means the ability to specify, purchase and install with the utmost confidence and with a minimum of effort and expense. To the owner it means standardization of equipment with consequent ease of maintenance.

The Auth Electric Company has been a responsible manufacturer of signaling systems for many years. It supplies all the necessary components for the installation of complete systems; also, all required specification and engineering data. Your nearest Auth office will be glad to give you information on Auth Signaling Systems, or you may write directly to the **Auth Electric Company, Inc., 34-20 45th St., Long Island City 1, New York.**

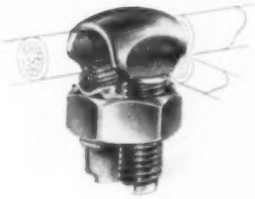
SINCE 1892

AUTH

FOREMOST IN THE DESIGN AND MANUFACTURE OF ELECTRICAL SIGNALING, COMMUNICATION, TIME, AND PROTECTIVE EQUIPMENT FOR SCHOOLS, HOSPITALS, HOUSING, OFFICES, SHIPS, AND INDUSTRY.

FOR EVERYTHING ELECTRICAL . .

for CONNECTORS...



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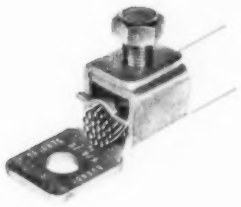

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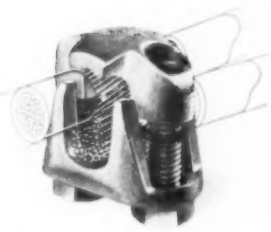

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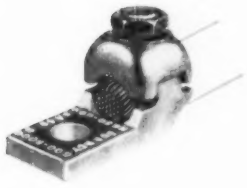

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BURNDY

YOUR BASIC SOURCE

FOR LATEST DEVELOPMENTS

IN ELECTRICAL CONNECTORS

ASK YOUR LOCAL DISTRIBUTOR FOR A FREE COPY OF THE BURNDY POCKET CATALOG OF WIRING INFORMATION

With more than 30,000 individual Burndy connector designs—Burndy is ready to serve your connector needs promptly, efficiently. 70 graduate engineers will help you solve any connector problems in joining, terminating, clamping, or grounding every size and type of electrical conductor.

Burndy connectors and tools provide maximum mechanical strength and electrical efficiency —at low installation cost. Write for free technical counsel or catalogs . . . to

BURNDY—**NORWALK, CONNECT. · FACTORIES: NEW YORK · CALIFORNIA**

53-14

. . CALL **WESCO**

HERE'S A STORY EVERY PLANT OPERATING MAN SHOULD READ

"Heating in our main switch was causing Shutdowns But we stopped them cold by changing to Fusetron dual Element Fuses"

"In the Fall of 1951 in our cafeteria, we installed a new 1200 ampere switch. This switch controlled the lighting, refrigeration and a 115 ton air conditioning load.

"Everything was fine until the temperature reached 85 degrees and the summer air conditioning load came on. Then we had trouble.

"Three times in May, 1952 during our noon rush our whole place was shutdown.

"Our dining rooms seat 500 people at a time, so you can see what a shutdown during the noon rush means to us.

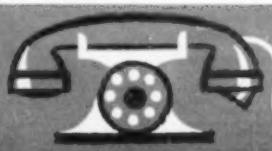
"We were fighting mad about the whole affair as the installation was practically new. Mr. Menees of the Arkansas Power and Light Co. was called in.

"He suggested that the trouble was due to the adding of the summer temperature to the normal heating of the fuses. Then he recommended that we discard our ordinary fuses and install FUSETRON dual-element fuses, as these modern fuses operated at a much cooler temperature than other fuses.

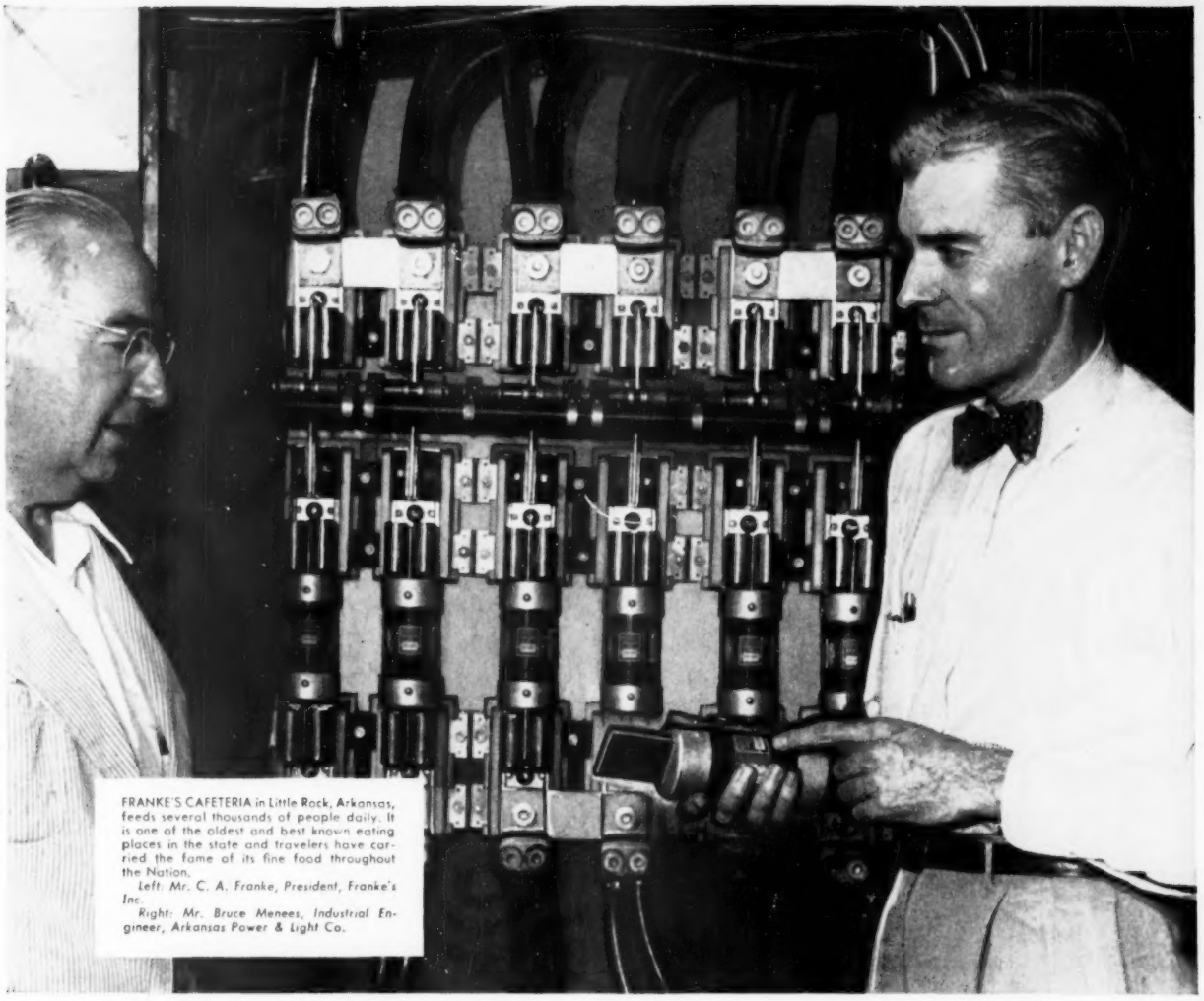
"This we did. To date, June 19, 1953, over one year since we made the change we have not had a shutdown due to a fuse blowing even though today's temperature outside is over 100 degrees.

"The cooler operation of FUSETRON fuses stopped shutdowns cold for us."

C. A. Franke, President
Franke's Inc., Little Rock, Ark.



FOR EVERYTHING ELECTRICAL . .



FRANKE'S CAFETERIA in Little Rock, Arkansas, feeds several thousands of people daily. It is one of the oldest and best known eating places in the state and travelers have carried the fame of its fine food throughout the Nation.

Left: Mr. C. A. Franke, President, Franke's Inc.

Right: Mr. Bruce Menees, Industrial Engineer, Arkansas Power & Light Co.

You too, can profit by the 10 POINT PROTECTION of FUSETRON dual-element FUSES

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

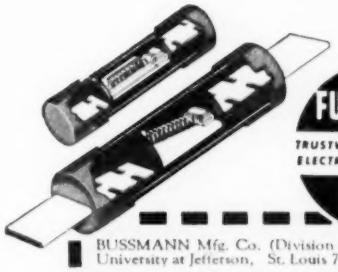
8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.



FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FOR MORE INFORMATION *use this Coupon*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

Address _____

City & Zone *State* ECM-1153

.. CALL WESCO

WHY RISK SHUTDOWNS?

WESTINGHOUSE INVENTORY PLAN GIVES YOU THE ELECTRONIC TUBES YOU NEED WHEN YOU NEED THEM

Switch from the old-fashioned method of searching for tube replacements — make sure you have 'em at your finger tips.

Production stoppages can be avoided. Here's how —

A reliable Westinghouse distributor will inventory your equipment and analyze your tube needs. He will prepare an ideal stocking plan. He will maintain a stock reserve specifically for you in his warehouse. This personalized stock is over and above your normal inventory of spare tubes you maintain for emergency breakdown.

Your Westinghouse distributor provides immediate service. In case of emergency, a call to him will bring your personalized tube replacement in a matter of minutes.

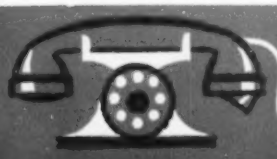
Why risk production losses any longer? Accident may strike today . . . tomorrow. Take advantage of the Westinghouse Inventory Plan as soon as possible. Call your Westinghouse distributor or write Dept. F-103.

YOU CAN BE SURE...IF IT'S Westinghouse

ET-95017-A

RELIATRON™ TUBES

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

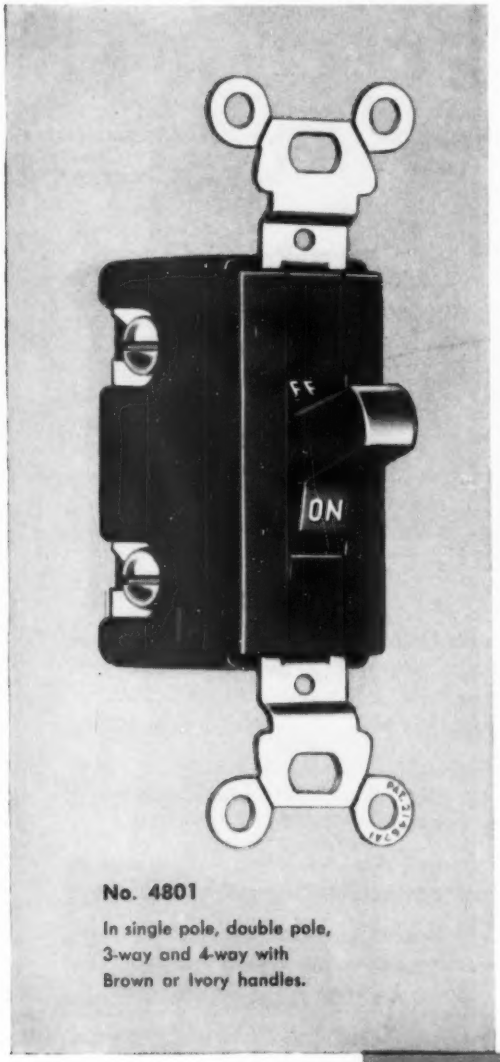


FOR EVERYTHING ELECTRICAL . .

Cut Job Costs with this New Bryant

A.C. QUIET SWITCH

Rated 15 Amperes, 120 Volts . . . 15 Amperes, 277 Volts



No. 4801

In single pole, double pole, 3-way and 4-way with Brown or Ivory handles.

The new 4801 line of Bryant A.C. switches offers you radically new and improved features now permissable under recently adopted Underwriters' and Code Standards. For commercial, institutional, industrial and residential applications look to this quality-built Bryant switch for lower wiring costs and vastly improved electrical service . . . here's why —

1. The 4801 is the first switch permitting full ratings for use on fluorescent (inductive) loads. The 15 Amperes at full rating use means triple that of existing 10 Ampere switches for these applications. *This means fewer switches and lower job costs.*
2. Capable to the full rated capacity for *tungsten filament lamp loads.*
3. New 277 Volt rating provides for the popular 4-wire 480 277 Volt distribution system now being specified in many areas.
4. The 4801 is *ideal for Motor Control,* safely handling full load currents up to 80% of the switch rating.
5. *Much longer life* due to rugged construction and use of fine silver contacts.
6. *Back wiring* using full screw-clamp type of fastening already proved in installations, or conventional side wiring.
7. *Extremely quiet* . . . almost silent . . . due to unique mechanism design.
8. *Every modern feature* . . . strength . . . fully enclosed . . . easy, smooth operation . . . takes up to #10 wire . . . operates in any position.

Specify Bryant From Your Electrical Distributor

Listed by Underwriters' Laboratories, Inc.

BRYANT
SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago • Los Angeles

. . . CALL WESCO

Four Steps That Mean

Easier, Quicker, Safer Installation of

CRESCENT

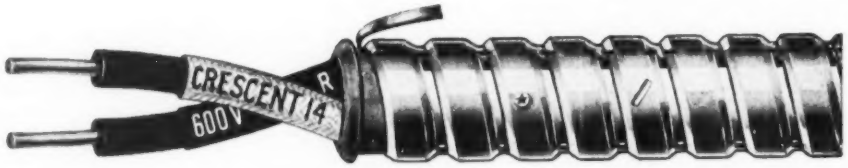
A B C ARMORED CABLE

1 FILE OR SAW GUIDED BY CUTMARK

2 BREAK ARMOR

3 PULL OUT PAPER

4 INSERT INSULATING BUSHING



★ **NOTE CUTMARK** on the fourth turn from right on armor of cable above. This cutmark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the cutmark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

★ **NOTE BOND WIRE UNDER ARMOR** which is in contact with the under side of each convolution. This provides permanently low armor resistance. It is furnished in sizes No. 14 and 12 AWG Cable.

★ **GENUINE A B C CONSTRUCTION** provides for easy insertion of the insulating bushing because the paper under the armor readily *unwraps from under both ends* providing space to insert the bushing.

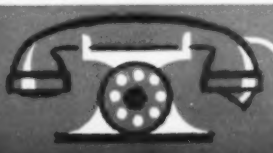
★ **All GLASS BRAIDS** protect the rubber insulated conductors, and are flame, moisture and rot proof. The use of ALL GLASS braid results in a cable with smaller diameter and lighter weight, being easier to handle and install.

CRESCENT
WIRE & CABLE

OVER 70 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.



FOR EVERYTHING ELECTRICAL . .

Let Us Help You End Confusing FUSE Problems!

Many plants have unusual wiring circuits, or special electrical equipment that requires out-of-the-ordinary types of fuses.

You will probably find exactly the fuse to suit these requirements, in the complete Economy Fuse Line. In addition to the famous Economy Renewable Fuses and Renewal Links — for restoring fuses, blown by overloads, to their original efficiency almost instantly — Economy Fuses include regular and special fuses for every possible industrial, commercial or domestic building installation. We list and illustrate only a few of these here.

Your Electrical Wholesaler can show you these various types of fuses and suggest the one that is best suited for your needs. In addition to his own wide experience, he has at his command, the combined experience of Economy Engineers who have been supplying fuses to meet every kind of requirement, for more than 42 years.

See your Electrical Wholesaler Today.

Partial list of Economy Fuses

Arkless Indicating
Clearsite
Economy Renewable Fuses and Renewal Links
Econ Dual Element Fuses
Eco One-time Non-Indicating
Fustats
Renewable Plug Fuses
Transpro Fuses and Receptacles

Also Clip-Tites and Fuse Pullers and many others for all fuse requirements

ECONOMY fuses for every purpose

ECONOMY FUSE & MANUFACTURING CO.
2717 Greenview Avenue Chicago 14, Illinois

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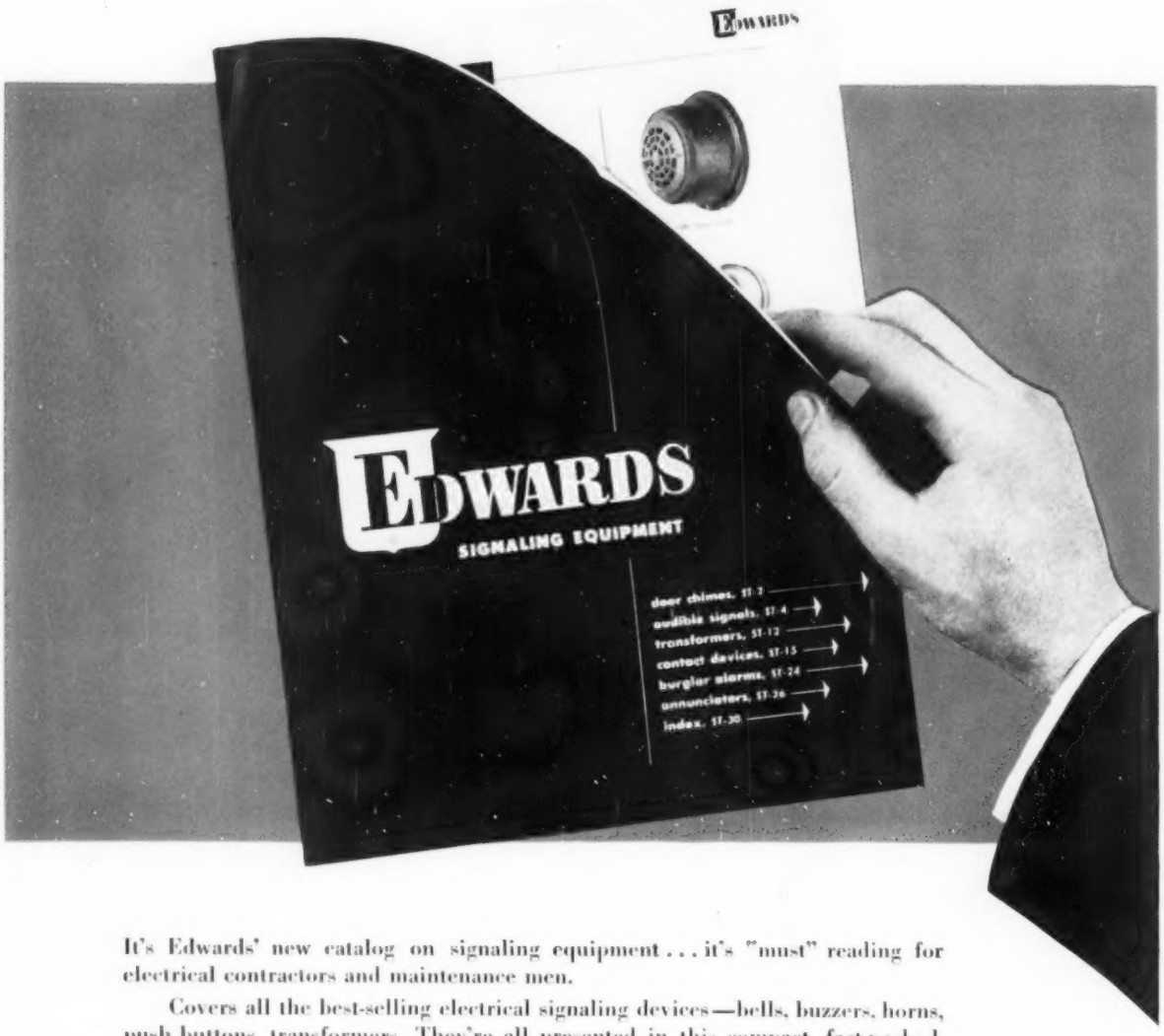
attention!

for signals...



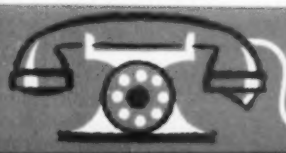
It's Edwards' new catalog on signaling equipment . . . it's "must" reading for electrical contractors and maintenance men.

Covers all the best-selling electrical signaling devices—bells, buzzers, horns, push buttons, transformers. They're all presented in this compact, fact-packed, 32-page catalog for quick, easy reference.

This is one more instance of Edwards' continuing cooperation with distributors, installers, and users of Edwards equipment. Write us today for your copy —Edwards Company, Inc., Dept. EC-11, Norwalk, Conn.

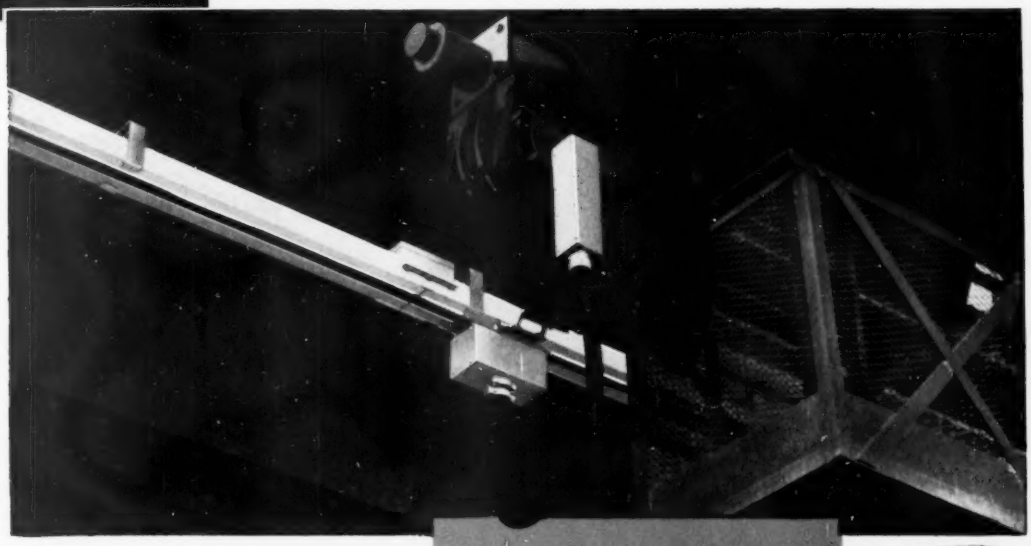
EDWARDS

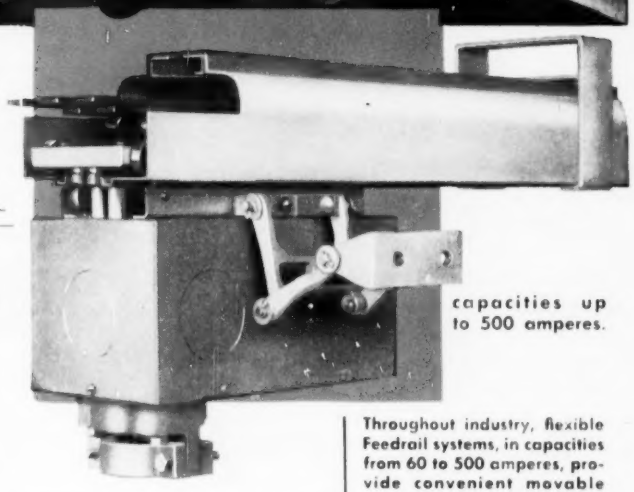
. . . complete protection for distributors
. . . ease of installation for contractors
. . . greater service and satisfaction for users



FOR EVERYTHING ELECTRICAL . .

safe electrification for HEAVY DUTY CRANES and HOISTS





FEEDRAIL®

Moving POWER SYSTEMS

capacities up to 500 amperes.

No longer need your Crane and Hoist wiring endanger workers or be a potential fire hazard to your plant. The new Heavy Duty Feedrail trolley busways give you the *safe* way because:

1. **They are a built-for-the-purpose system, designed and constructed expressly for high amperages.**
2. **All current carrying conductors and trolley contacts are protected every inch of the way.**

But, maximum safety is only one advantage you get from Heavy Duty Feedrail. The system — accurately, ruggedly constructed — fits into your specific application requirements, its standardized components making for an easy installation. And, you'll find its low maintenance, long life and continuous dependable service are economy factors in plant operation.

write for HEAVY DUTY Catalog No. 30.

Tells you all about this new Heavy Duty system of electrification, including installation planning and specifying data. Like this catalog . . . engineering cooperation is always available . . . without any obligation. Address Dept. C-11

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

Throughout industry, flexible Feedrail systems, in capacities from 60 to 500 amperes, provide convenient movable power sources for production, testing and materials handling. These can serve you in:

- Cranes and Hoists
- Production Lines
- Conveyor Assembly Lines
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- Portable Tools
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- Motor Control

ELECTRIC FEEDRAIL®

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FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

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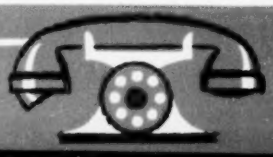
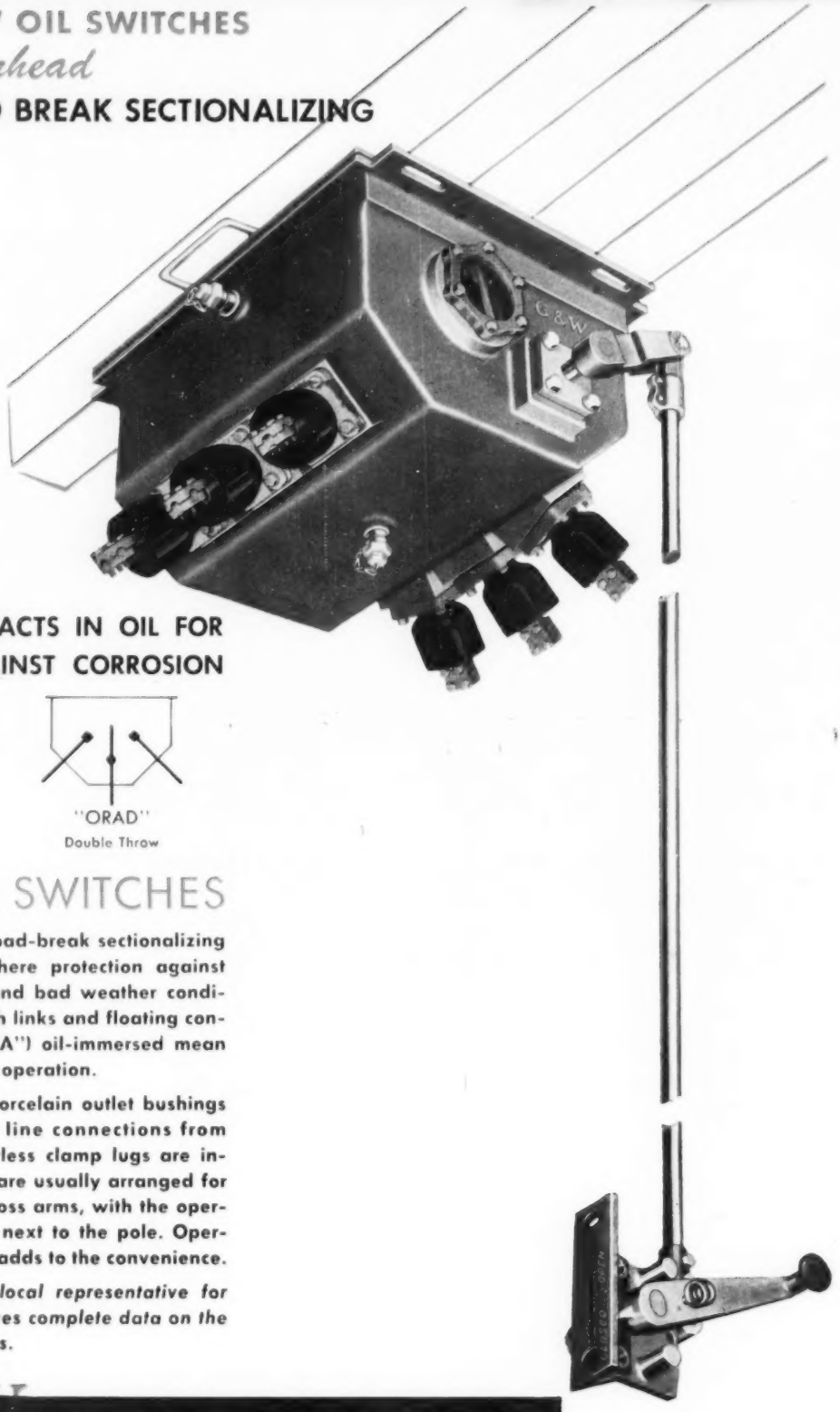


INSTALL G & W OIL SWITCHES *Overhead* FOR FULL LOAD BREAK SECTIONALIZING



SWITCHING CONTACTS IN OIL FOR PROTECTION AGAINST CORROSION

"ORA" Single Throw

"ORAD" Double Throw

"ORA" OIL SWITCHES

Recommended for full load-break sectionalizing of overhead circuits where protection against atmospheric corrosion and bad weather conditions is important. Switch links and floating contacts (standard Type "RA") oil-immersed mean permanent trouble-free operation.

The angle location of porcelain outlet bushings facilitates making the line connections from above or below. Solderless clamp lugs are included. The steel tanks are usually arranged for hanging from double cross arms, with the operating lever on the side next to the pole. Operation from ground level adds to the convenience.

Write us or ask your local representative for Bulletin DB51, which gives complete data on the "RA" line of oil switches.

G W ELECTRIC SPECIALTY CO.

7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.

Cable terminating, connecting and sectionalizing devices

Representatives in principal cities of U. S. A. In Canada—Powerlite Devices, Ltd., Toronto and Montreal

FOR EVERYTHING ELECTRICAL . .

TEAMED UP FOR SERVICE...

Only a complete line of the best that engineering experience and performance can produce is adequate to meet the demands of our customers. This means, every company on our team must maintain manufacturing standards of the highest order. Such has been the achievement of General Cable—whose wire and cable products have always provided outstanding quality and performance.

- BARE WIRES AND CABLES
- OK®—PEERLESS®—TIP-TOP® WEATHERPROOF WIRES
- GUARDIAN® BUILDING WIRES AND CABLES—THERMOPLASTIC AND RUBBER INSULATED
- ROMEX® AND ROMEX-N NON-METALLIC SHEATHED CABLES
- VARNISHED CAMBRIC POWER AND CONTROL CABLES, THERMOPLASTIC AND THERMOSETTING JACKETED, BRAIDED, OR LEAD SHEATHED
- SUPER SERVICE AND OTHER PORTABLE CORDS AND CABLES
- SERVICE CABLES—ALL TYPES

® TRADE MARKS REG. U. S. PAT. OFF

"More Power to You"

GENERAL CABLE
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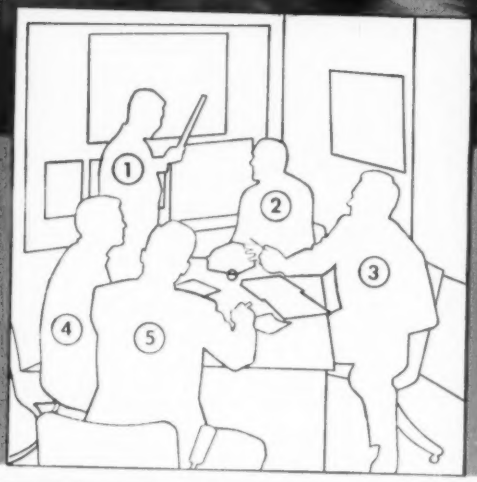
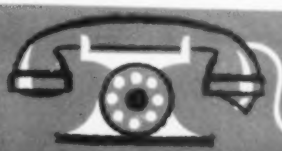
1. Westinghouse Application Engineer
2. Westinghouse Sales Engineer
3. Chief Engineer
4. Electrical Engineer
5. Production Superintendent





FOR EVERYTHING ELECTRICAL . .

Your motor and control problems are local . . . so is Westinghouse application assistance

Do you put a full team on the field when you tackle a motor and control application problem? Are you cashing in on the know-how of your local staff of Westinghouse application engineers? Take a look at this line-up:

Your local Westinghouse sales engineer has a broad knowledge of all Westinghouse Motors and Controls. He knows their capabilities and limitations. He knows how to match motors and controls for maximum production.

Your local Westinghouse application engineer is equipped to analyze any motor and control problem and then develop the best solution. He can handle any application problem from a simple machine tool to a complete production line.

Your local Westinghouse product engineer is a specialist in one type of motor or control. These men work at the local level but operate from a manufacturing headquarters office.

Enlist the services of these men on your next motor and control application job. Call your local Westinghouse office for further details, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. 3-21746

Application engineers work out of 126 Westinghouse offices

Akron 8, Ohio	JEfferson 3165	Fort Wayne 2, Ind.	ANthony 3421	Pittsburgh 30, Pa.	ATlantic 1-8400	Spokane 8, Wash.	MAin 3294
Albany 5, N. Y.	8-7801	Fort Worth 2, Tex.	FOrtune 4086	Portland 4, Ore.	CApitol 1-9151	Springfield, Ill.	3-1535
Albuquerque, N. M.	3-1826	Fresno 1, Cal.	4-5097	Providence 3, R. I.	GAspee 1-0818	Springfield 3, Mass.	6-8373
Allentown, Pa.	HEmlock 4-5108	Gary, Ind.	2-1468	Raleigh, N. C.	6302	Syracuse 4, N. Y.	2-1361
Amarillo, Texas	6-7838	Grand Rapids 2, Mich.	9-3106	Reading, Pa.	2-0287	Tacoma 2, Wash.	BRoadway 6565
Appleton, Wis.	4-4116	Greensboro, N. C.	2-3415	Richmond 19, Va.	2-4758	Tampa 1, Fla.	2-7246
Atlanta 2, Ga.	ATwood 1642	Greenville, S. C.	3-7755	Roanoke 4, Va.	6263	Toledo 4, Ohio	GArfield 4625
Augusta, Maine	3-4571	Hammond, Ind.	RUssell 8937	Rochester 7, N. Y.	MOnroe 1635	Trenton 10, N. J.	2-4136
Baltimore 2, Md.	PLaza 0300	Hartford 3, Conn.	5-0851	Rockford, Ill.	2-3452	Tulsa 3, Okla.	3-3191
Beaumont, Tex.	4-1481	Houston 2, Tex.	CHarter 4691	Rutland, Vt.	3292	Utica 1, N. Y.	4-1194
Binghamton 62, N. Y.	2-6403	Huntington 1, W. Va.	7146	Sacramento 14, Cal.	GIlbert 3-6525	Walla Walla, Wash.	5124
Birmingham 3, Ala.	53-2411	Indianapolis 9, Ind.	MArket 3301	Saginaw, Mich.	4-2640	Washington 6, D. C.	NAtional 8-8843
Bluefield, W. Va.	3-9131	Jackson, Mich.	2-0519	St. Louis 1, Mo.	CEntral 1120	Waterloo, Iowa	4679
Boston 10, Mass.	LIberty 2-0600	Jackson, Miss.	6-4839	Salt Lake City 1, Utah	5-3413	Watertown, N. Y.	1400
Bridgeport 8, Conn.	4-0151	Jacksonville 6, Fla.	78-6492	San Antonio 5, Tex.	GArfield 5114	Wheeling, W. Va.	6222-6223
Buffalo 3, N. Y.	WAshington 3966	Jamestown, N. Y.	8939	San Diego 1, Cal.	MAin 8151	Wichita 2, Kansas	5-2631
Butte, Mont.	2-2301	Johnstown, Pa.	81-257	San Francisco 8, Cal.	EXbrook 2-5353	Wilkes-Barre, Pa.	3-1144
Canton 2, Ohio	3-9171	Kansas City 6, Mo.	HArrison 7122	Seattle 4, Wash.	MAin 0808	Williamsport, Pa.	4289
Cedar Rapids, Ia.	7638	Kingsport, Tenn.	3769	Shreveport, La.	4-5298	Worcester 8, Mass.	4-2648
Charleston, S. C.	9904	Knoxville 8, Tenn.	2-8101	Sioux City 4, Iowa	5-7634	York, Pa.	7851
Charleston 1, W. Va.	37-565	Little Rock, Ark.	4-0367	South Bend 4, Ind.	3-7167	Youngstown 3, Ohio	4-1118
Charlotte 1, N. C.	5-3731	Los Angeles 17, Cal.	MAdison 6-3881				
Chattanooga 2, Tenn.	7-4361	Louisville 2, Ky.	CLay 0212				
Chicago 54, Ill.	WHitehall 4-3860	Madison 3, Wis.	5-4868				
Cincinnati 2, Ohio	GArfield 2250	Medford, Ore.	2-8289				
Cleveland 13, Ohio	CHerry 1-7600	Memphis 3, Tenn.	8-8546				
Columbia, S. C.	3-8823	Miami 4, Fla.	2-1553				
Columbus 15, Ohio	MAin 5527	Milwaukee 2, Wis.	DAly 8-1800				
Corpus Christi, Tex.	3-9237	Minneapolis 13, Minn.	GRanville 3545				
Dallas 1, Tex.	RIverside 5231	Mobile, Ala.	8-5443				
Davenport, Ia.	3-2761	Nashville 3, Tenn.	42-3505				
Dayton 2, Ohio	ADams 9153	Newark 2, N. J.	MArket 2-0200				
Denver 2, Colo.	KEystone 8121	New Haven 10, Conn.	5-3191				
Des Moines 8, Iowa	2-0244	New Orleans 13, La.	RAymond 8656				
Detroit 31, Mich.	TRinity 2-7010	New York 5, N. Y.	WHitehall 3-4321				
Duluth 2, Minn.	7-1541	Niagara Falls, N. Y.	9700				
El Paso, Tex.	2-5691	Norfolk 10, Va.	5-1639				
Emeryville 8, Cal.	OLympic 2-3770	Oklahoma City 2, Okla.	REgent 6-1633				
Erie, Pa.	24-867	Omaha 2, Nebr.	HArney 8700				
Evansville 8, Ind.	5-7146	Peoria 3, Ill.	2-5439				
Fairmont, W. Va.	501	Philadelphia 4, Pa.	EVergreen 2-1200				
Fergus Falls, Minn.	4250	Phoenix, Ariz.	4-3158				

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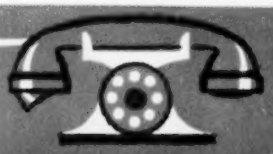
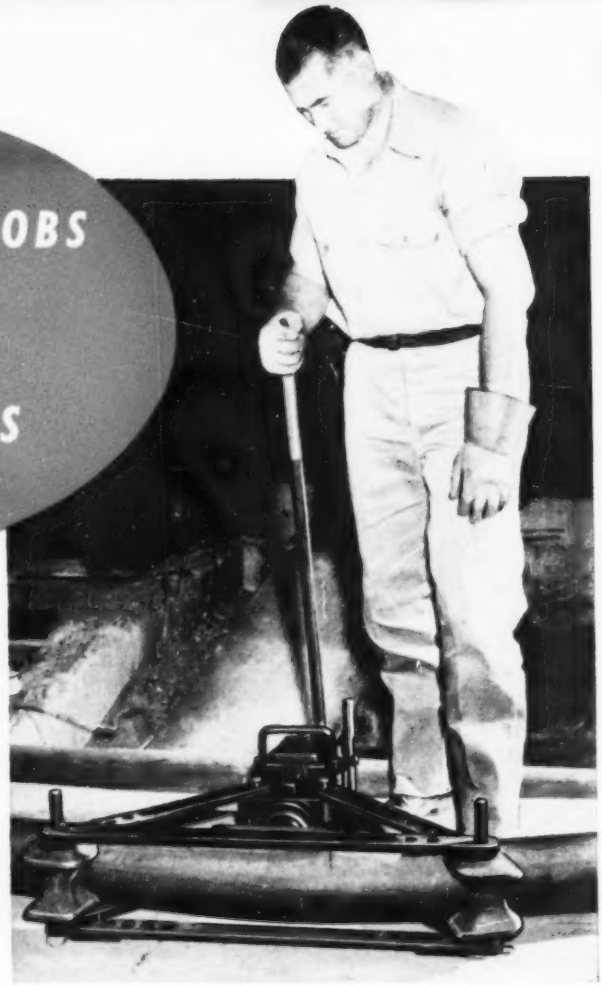


CUT COSTS...SPEED JOBS WITH GREENLEE TIMESAVING TOOLS



Greenlee Hydraulic Conduit Bender

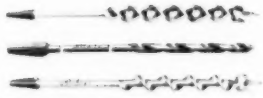
Conduit installations go far faster . . . neat, tailor-made jobs result every time with a GREENLEE Bender. Many owners report labor savings from 50% to 90% . . . and the cost of many manufactured bends and fittings is eliminated. For, with the GREENLEE, *one man* in but minutes makes smooth, accurate bends in pipe up to 5", rigid and thin-wall conduit, tubing and bus bars. Compact and portable, the GREENLEE Hydraulic Bender can be easily and quickly moved for *on-the-job bending* exactly where and when wanted! *Users say it often pays for itself on the very first job.*

Hand Benders for Tubing

Swiftly produce accurate small-radius bends (up to 180°) in conduit, pipe and tubing. No flattening or kinks. GREENLEE Hand Benders are especially designed to form neat bends to fit sharp corners, nooks and other close quarters. Eliminates need for many manufactured bends and fittings. Various sizes and models . . . handy companion tools to GREENLEE Hydraulic Benders for quickly "custom making" your own complete conduit installations *right on the job.*

Knockout Punches and Hydraulic Punch Driver

Quick, easy way to make knockout enlargements for ½" to 4" conduit. Simply insert GREENLEE Knockout Punch in knockout or small drilled hole, then turn with an ordinary wrench. For an even faster, practically effortless operation, drive Punch with powerful, portable GREENLEE Hydraulic Driver shown below.

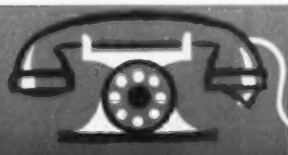


Boring Tools For quickly making clean, smooth openings for conduit and wiring. The GREENLEE line includes Electricians' Unispur and Solid-Center Auger Bits, Bell Hangers' Drills, Expansive Bits, and Bit Extensions.

Cable Puller Easy-operating, compact unit for 7,500 pound pull. Fastens directly to conduit for pulling in line with conduit . . . no loosened hangers. Attachment available for concealed conduit work.

SEE YOUR ELECTRICAL DISTRIBUTOR Get complete information on the above and other GREENLEE timesaving tools: Hydraulic Pipe Pushers • Joist Borers • Chisels and Gouges • Radio Chassis Punches • Angle-Screw Drivers • Spiral Screw Drivers • Automatic Push Drills • and many more. Greenlee Tool Co., 1751 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE



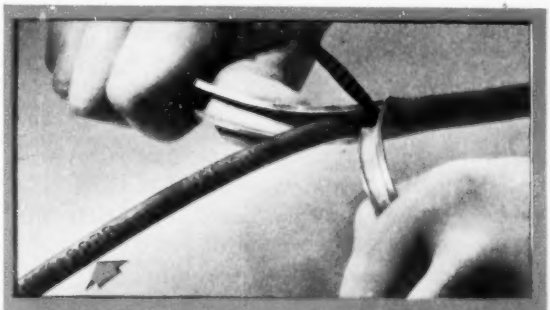
FOR EVERYTHING ELECTRICAL . .

mold-cured HAZACORDS
give better service...longer life

Fewer replacements . . . less time lost . . . lower operating costs—that's what using Hazacord means to you. Regardless of the treatment it gets, mold-cured Hazacord has the "built-in" ability to absorb more punishment and stay on the job longer—that's why it's preferred for economical service on rugged industrial jobs everywhere.

Every Hazacord flexible cord and portable cable is protected with Hazard's exclusive Hazaprene ZBF sheath which means extra resistance to such common industrial perils as oils, acids, chemicals, moisture and weather. In addition, the Hazaprene sheath is *cured under pressure in a continuous metal mold*—the best method known to provide extra density, lasting toughness, a smooth, abrasion-resistant surface. And its high flame resistance more than meets the requirements of the Federal Bureau of Mines and the Pennsylvania Department of Mines.

There's a Hazacord flexible cord or portable cable for every need. Ask your jobber about Hazacords today. For the complete catalog of Hazacord flexible cords and portable cables EC-420 write to Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.



Feel the embossed name Hazacord on the sheath—positive proof of a mold-cured cord. And mold-curing means *extra* long life to portable cords.

HAZARD insulated wires and cables for every electrical use

HAZACORDS AVAILABLE THROUGH YOUR WESCO JOBBER

. . . CALL **WESCO**

7 reasons why ILG fans are your best buy

1. "One-Name-Plate" Guarantee covers both motor and fan
2. Rugged cast frame keeps working parts aligned for decades
3. No belts to stretch, wear out, need replacing
4. No pulleys to waste power, get out of alignment
5. Self-Cooled Motor never "gums-up"
6. Double-sealed, permanently lubricated, ball bearing motor
7. Patented ILG fan blades deliver more air quietly, with greater efficiency
CHICAGO USA

Maintenance-free as propeller fans can be!

• Rarely will you find mechanical equipment as trouble free as ILG fans. Performance records in thousands of buildings prove that you "install 'em and forget 'em." There's nothing to get out of order and cause objectionable noise, inefficient operation, or rapid wear. No belts or pulleys to adjust or replace.

Every possible precaution is taken by ILG to assure finest performance. Each fan is made to ILG's high standards of quality . . . capacity ratings are certified . . . direct connection of motor and fan wheel for permanent alignment . . . each moving part is electrically balanced . . . each complete fan, including the motor, is backed by ILG's "One-Name-Plate" Guarantee.

A complete line is now available to you—6" to 72" diameter fans . . . standard, two-speed, or explosion-proof motors . . . mountings for wall, window, or roof-top . . . fan guards and automatic shutters available for all sizes.

ILG knows ventilation!

Get the complete story in Bulletin 150-1—call nearby Branch Office (consult classified directory) or write us today.

ILG ELECTRIC VENTILATING CO.
2379 North Crawford Avenue, Chicago 41, Illinois
Offices in more than 30 Principal Cities

FOR EVERYTHING ELECTRICAL . .

"Tool-Up" for Easier Wiring Jobs —AT LOWER COST!

Always Safe!

IDEAL

Wire-Nuts®

Patented, No. 1,933,555
THE SOLDERLESS, TAPELESS WIRE CONNECTORS

- Twists, Threads, Grips and Insulates—ALL AT ONCE!
- No Special Tools
- Only ONE Piece to Handle

The Easiest Way to Make Fully Approved PIGTAIL SPLICES

Just screw a "Wire-Nut" on the stripped ends of the wires and you have a pull-proof, shake-proof splice that's actually stronger than the wire itself. You can't make a safer, stronger or longer-lasting splice.

"Wire-Nuts" Are Now Better Than Ever!

NEW phenolic compound shells are stronger—have higher dielectric—NEW buttress threads hold wire insulation tighter in skirt . . . NEW knurling makes them still easier to apply . . . NEW automatic machine assembly and inspection insure 100% uniformity in size, quality and finish.

Millions More "Wire-Nuts" are Used and in Use than Any Other Connector

Spliced for Life!

Contractors sizes 74B and 76B are fully approved as pressure cable connectors for general use in all types of branch circuit wiring. For all common wire combinations.

IDEAL Set Screw CONNECTORS

- Extra Strong Shell
- Extra High Dielectric
- Extra Strong Skirt
- Solid Brass Sleeve and Set-Screw

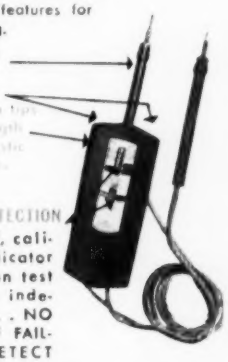
For Super-Strong, Super-Safe Pigtail Splices That You Can Inspect at Any Time

Takes just a few seconds per splice—and all you need is a screw-driver. Approved for 600 volts as pressure cable connectors for general use. High safety margin assured by 8000 volt dielectric and air gap tests and 80-lb. pull-out test. Easy to unscrew and re-use. Perfect for use when circuit layouts are planned for possible future change. Just two sizes needed for all common wire combinations.

THE NEW SUPER SAFE IDEAL Voltage Tester

You Can't Buy a Safer Tester —to Save Your Life!

The Voltage Tester that's safety-engineered at every point—with new convenience features for easier testing.



Demountable center guard
Prod storage shields clamp tips
Double strength seamless plastic case—no soft face metal

DOUBLE PROTECTION a solenoid, calibrated indicator AND a neon test lamp, each independent . . . NO CHANCE OF FAILURE TO DETECT VOLTAGE.

Cut Fishing Time in Half!

IDEAL

FISH TAPE, REEL and PULLER

Gives BIG pull and sure, safe grip that makes it easy to handle even long conduit runs. Tape is always under control—in the reel or in the conduit. Easy to reel in or pay out. Five sizes, 50 to 200 feet.

Save Time and Eliminate Wire Waste

IDEAL **WIRE STRIPPERS**

"E-Z"

The rugged, all-steel tool for heavy-duty stripping. Can't crush stranded wire. Six sizes, for wire gauges 8 to 30, plus 300 ohm Twin TV wire.

Strijamaster

The light weight "automatic" stripper with unique single-squeeze action. Almost effortless to use because of easy action and narrow handle span. Five sizes for all wire gauges from 8 to 22.

Other IDEAL Work-Saving Tools

B-X Cable Cutters
Fuse Clip Clamps and Reducers
Fuse Pullers
"Wire-Lube" Wire Pulling Lubricant

IDEAL HAS WHAT YOU NEED FOR EVERY WIRING JOB!

IDEAL

IDEAL INDUSTRIES, Inc.

1041 Park Avenue, Sycamore, Illinois

CALL **WESCO**

INTER-MATIC®

. . . ALWAYS YOUR BEST TIME SWITCH BUY!

Now Available In A Complete Line-

SERIES TS60
(Standard Type)

Single pole, double pole, single throw, and double throw models. Heavy duty—rated 35 amperes at 125 volts. Large, silver, snap-action contacts. From one to twelve "on" and "off" operations a day. Manual control-automatic reset. Convenient mounting holes and knockouts, and plenty of extra room for wiring.

SERIES TS66
("Skipper" Type)

For control applications where it is desired to skip operation of the time switch on Saturdays, Sundays, Holidays, or other selected days. Ideal for automatic control of heating systems, portable room air conditioners, manufacturing processes, etc. Available in single pole, double pole, single throw, and double throw.

SERIES T670
(For "On-Off" Cycles Less Than One Hour)

Up to 12 on-off cycles a day. Each cycle independently adjustable from 5 to 60 minutes. For commercial refrigeration defrosting, automatic poultry feeders, process timing, oil well and water well pumping, hay dryers, ventilating fans. 35 amperes at 125 volts. Single pole and single pole double throw.

TIME-ALL
(Portable Plug-In Appliance Time Switch)

Turns appliances on-off automatically. Performs day after day without resetting. Can be set to skip its automatic operation for a day or longer. Defrosts refrigerators, wakes to music, protects home with light when owner is away. Controls coffee-makers, fans, heaters, electric blankets and many others. Beautiful gray plaskon case, 1650 watts, 6 ft. cord set.

POULTRY TIME SWITCHES

Models for all lighting schedules. Standard single pole, single throw for morning lighting only or all night lighting. For morning and evening lighting or evening lighting only, there's the Inter-Matic poultry dimmer switch. Both type switches also available for portable plug-in use.

FEATURES YOU'LL LIKE

Easy TO REMOVE MECHANISM —just press spring.

Easy TO CHECK operation of the motor thru window in motor cover.

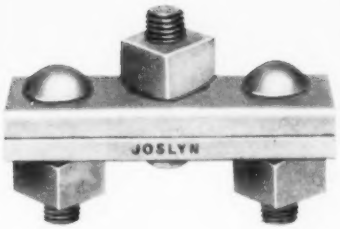
Easy TO SET TIME — just pull dial forward — turn in either direction.

Easy TO ADD EXTRA TRIPPERS without removing the dial.

Mf'd by INTERNATIONAL REGISTER CO., 2624 W. Washington Blvd., Chicago 12, Ill.

FOR EVERYTHING ELECTRICAL.

J768 Secondary Rack



J931 Guy Clamp

J1118 Pole Step

J1092 Eyenut

COMPLETE

JOSLYN

POLE LINE EQUIPMENT

Is Available
at Your Local
Westinghouse Electric Supply
Company Office

JOSLYN MFG. AND SUPPLY CO.
Executive Home Offices: 20 North Wacker Drive
CHICAGO 6, ILLINOIS

J0341 Cross Arm Clevis

J6270 Universal
Pole Band

J8152
Angle
Thimbleye
Bolt

5/8" x 12"

J3038 Tubase Guy Clip

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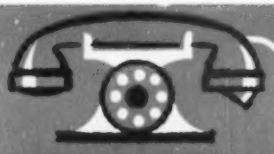
Look how easy Republic

ELECTRUNITE E. M. T. is approved by the National Electrical Code for concealed, exposed and concrete installations. It's also inspected and approved by Underwriters' Laboratories.

WITH ELECTRUNITE E. M. T., the completed job is neat. Journeymen like to work with this lightweight raceway, take pride in the finished job.

EVEN THE VIBRATOR can't loosen tight joints made with ELECTRUNITE E.M.T. using connectors and couplings. Ordinary precautions on the job are all that's necessary.



FOR EVERYTHING ELECTRICAL . .

ELECTRUNITE E·M·T·

Goes in on Concrete Deck Job

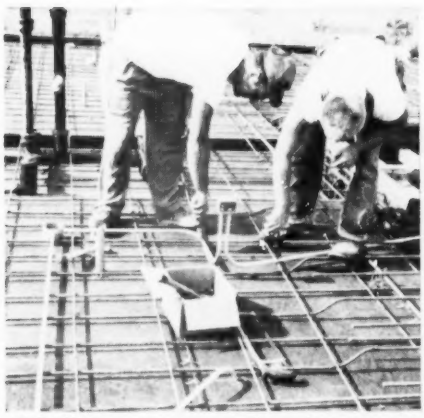
These photos of the Phillip Murray addition to Altgeld Gardens Community, Chicago, are proof that it pays to use ELECTRUNITE E.M.T. It's appoved for concrete slab, exposed and concealed construction by the National Electrical Code.

Journeymen like it because it's lightweight, easy to carry, easy to handle. Bending is easy, and accurate, because of the exclusive Republic Inch-Marking. Wire-pulling is easier because of inside knurling, another exclusive.

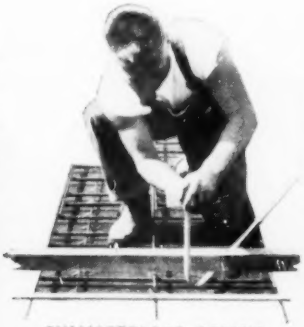
Installation is easy. Boxes, with connectors attached can be spotted on the form *before* making the connections. And that means a lot in high places . . . or on the ground where space to work is limited. All you turn is the nut. No need to turn the entire run to make a tight joint.

Add up all the advantages and you'll see why so many contractors specify Republic ELECTRUNITE E.M.T. If you want more facts, send for free booklet.

You Can Get Republic ELECTRUNITE E.M.T. From Your Local WESCO Dealer



IT TAKES a minimum number of simple tools when you install ELECTRUNITE E.M.T. Good ties to reinforcing rods are important.



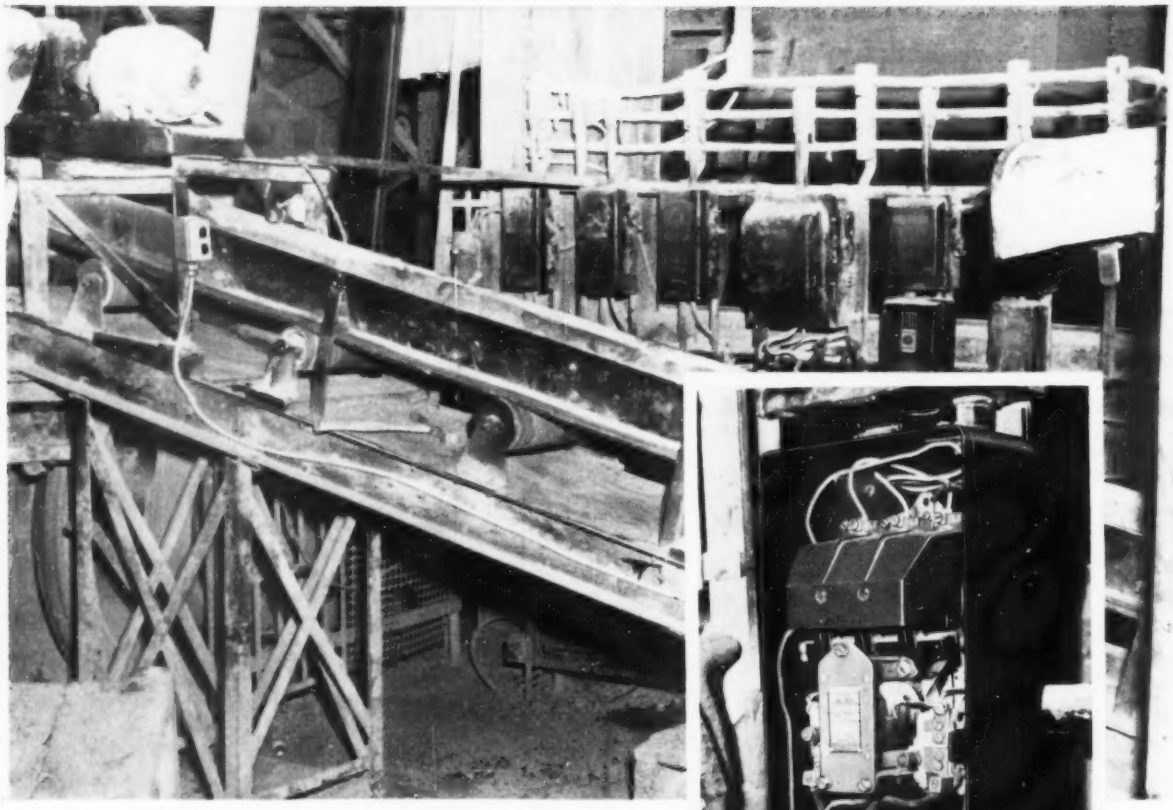
SYMMETRICAL BENDS are easy to make, using the Republic Bender. Installing tubing in the box is easy too, takes only one wrench because the connectors are put into the box beforehand. That's a big advantage in crowded quarters.

"INCH-MARKED" feature makes it easy to cut ELECTRUNITE E.M.T. accurately . . . without measuring. A 32-tooth hacksaw blade is recommended.

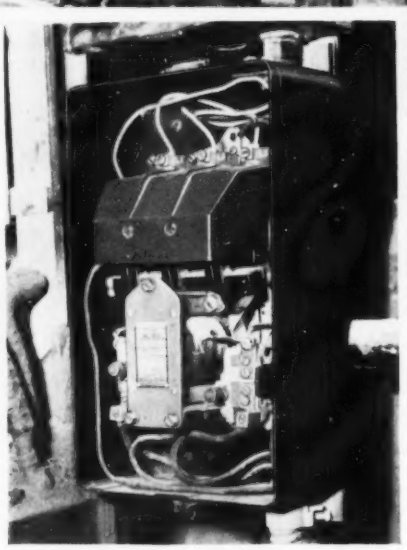
STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 East 131st Street • Cleveland 8, Ohio
Export Dept.: Chrysler Bldg., New York 17, N.Y.

Republic
REPUBLIC STEEL
ELECTRUNITE E.M.T.

. . CALL WESCO



Picking Conveyor Carrying Crude Aluminum Oxide



Westinghouse Life-Line Starter Takes Terrific Punishment

Compare...

Life-Line Starter's terrific punishment on this job—millions of operations, still no maintenance!

Exolon Company of Thorold, Ontario, reports amazing 23-month performance of Westinghouse Life-Line Starters under double hazards of continuous operation and abrasive atmospheres.

Installed in September, 1951, and controlling an inching task on a picking conveyor for crude aluminum oxide, the Westinghouse Starter has been operating up to 200 times an hour, 8 to 16 hours a day, 6 days a week without failure. Routine check in July, 1952, revealed that no parts needed replacement, that not so much as contact dressing was required.

Such outstanding performances of Westinghouse Life-Line Starters are being repeated everywhere in industry today. Bi-metal, disc-type overload relay protects motors and other equipment from damaging overload and burnout. De-ion® grid extinguishes equipment-killing arcs fast. Exclusive knife-edge bearing—the starter's only moving part—cuts friction and consequent wear.

Compare anywhere! Electrically and mechanically, Westinghouse Motor Controls are the most dependable investment you can make in grief-free production.

Call your Westinghouse Distributor, or write for Booklet B-5882, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30154

YOU CAN BE SURE...IF IT'S

Westinghouse

FOR EVERYTHING ELECTRICAL..

WESCO . . . a convenient source for

KAISER ALUMINUM CONDUCTORS

Your nearby Wesco Branch stocks Kaiser Aluminum covered and bare conductor in a wide range of sizes and types.

All these Kaiser Aluminum conductors cost *less* than copper conductors of equivalent current-carrying capacities. They are light in weight—string faster and easier, help cut installation costs. They reduce strain on house, pole, fittings—minimize costly maintenance and repair.

Your total saving with Kaiser Aluminum conductors can be as much as 35%.

. . . a convenient source for

KAISER ALUMINUM ENGINEERING SERVICE

Also available at no extra cost through your local Wesco Branch are Kaiser Aluminum's unsurpassed engineering services.

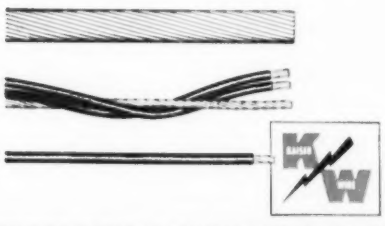
Field engineers work hand in hand with your crews; engineering specialists give personal attention to your planning and design; laboratories continually evaluate accessories and check all Kaiser Aluminum conductor against the highest standards of quality.

These services have helped hundreds of utilities do a better job at lower cost—and they can do the same for *you.*

Kaiser Aluminum

The Nation's Largest Producer of Aluminum Weatherproof Wire and Triplex

Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California



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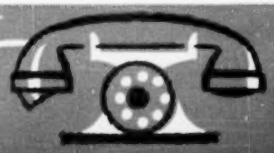

"EVEREADY" NO. 1251 INDUSTRIAL FLASHLIGHT

Ruggedly built to yield a dividend of longer service life. Case is resistant to shock, water, oils, greases, gasoline, alcohol and acids. The heavy duty switch is easily removed and replaced by hand; ring hanger in bottom cap.

"EVEREADY" NO. 1050 INDUSTRIAL FLASHLIGHT BATTERY

Delivers *twice* the usable white light of any previous "Eveready" flashlight battery. Specially designed for repeated, heavy-duty use. Will not stick, swell or jam in your flashlight—has no metal can to leak or corrode.

"EVEREADY" NO. 1259 INDUSTRIAL FLASHLIGHT
(APPROVED SAFETY TYPE)

This popular model is approved by the U. S. Bureau of Mines for use in Methane and Air Mixtures and is listed by Underwriters' Laboratories, Inc. for use in gas and air mixtures of Class 1, Groups C and D. Ring hanger and spare bulb in bottom cap.

"EVEREADY" NO. 409 LANTERN BATTERY

For years the standard of dependability and long life in every kind of service. Designed to fit many popular types of hand lanterns. Use it wherever brilliant white light is a must.

For

LONG LIFE, LOW OPERATING COST, DEPENDABILITY

•

specify these

EVEREADY
TRADE-MARK

products:

"EVEREADY" "IGNITOR" DRY CELL NO. 6

High quality and outstanding recuperative power make this battery the finest obtainable for such general applications as ignition, radio, bells, buzzers, electric games, toys, lanterns and other battery-operated devices.

"EVEREADY" RR AND INDUSTRIAL DRY CELL NO. 6

Specially designed to meet a wide range of service conditions, from very heavy to very light drains.

"EVEREADY" "COLUMBIA" "GRAY LABEL" TELEPHONE CELL NO. 6

Extraordinarily long life...the most widely used telephone dry cell in the world!

The terms "Eveready", "Ignitor", "Columbia", "Gray Label", "Nine Lives" and the Cat Symbol are registered trade-marks of Union Carbide and Carbon Corporation

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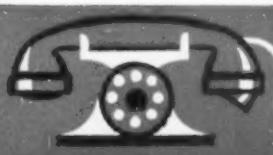
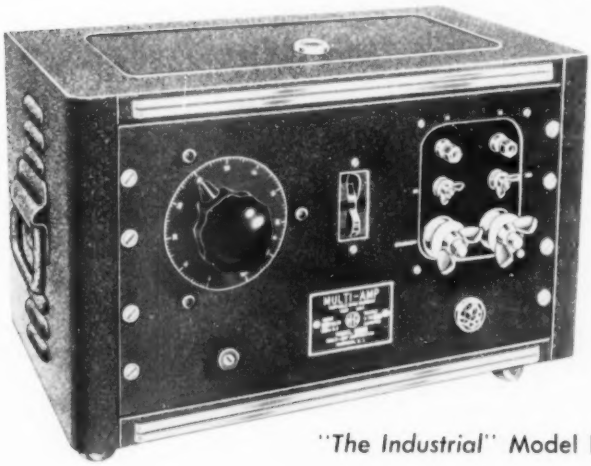


FOR EVERYTHING ELECTRICAL . .

Make sure you're safe!



"*The Industrial*" Model No. 1010

TEST ELECTRICAL OVERLOAD RELAYS & CIRCUIT BREAKERS

SAFELY, QUICKLY, ACCURATELY WITH

MULTI-AMP

At last — a portable, high current testing instrument that makes it possible to check and calibrate current actuated devices to make sure they are really protecting. Low in cost, economical, and simple to operate, the Multi-Amp makes *sure* you're safe. Its use can mean the difference between continuous operation or idle production lines.

MULTI-AMP CORP.
HARRISON, NEW JERSEY

DISTRIBUTED NATIONALLY BY
WESTINGHOUSE ELECTRIC SUPPLY COMPANY

This booklet tells how to avoid losses in time, equipment and production due to electrical overloads, short circuits, motor failures and electrical fires.

WRITE FOR YOUR COPY TODAY!

. . . CALL **WESCO**

Transformers with built-in breakers ...best circuit protection available

No matter how your distribution system is installed, recommended practice generally provides circuit protection at every transformer. But only Westinghouse Dry-Type Transformers with built-in breakers offer a combination like this:

- The dependable, trouble-free protection of a breaker.
- Three-way protection for the transformer itself.
- Substantial installation savings.

Integral breakers provide three-way protection because they are actuated by (a) coil load current; (b) temperature of the transformer; or, more commonly, by (c) a combination of both, since a rise in temperature increases the sensitivity of the breaker to overcurrent. The breakers are adjusted, however, for a coordinated time lag that permits non-damaging, short-time overloads without service interruption.

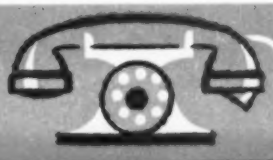
You'll find installed cost for transformers with integral breakers is substantially lower because there is only one unit to mount, one set of connections to complete the tie-in.

Westinghouse Dry-Type Transformers with built-in breakers, Types AJRB and AVRB, are available from 3 to 100 kva, single phase and 9 to 225 kva, three phase. J-70707

Check with your contractor, Westinghouse Distributor or local representative for full information. Or write for Booklets B-4428 and B-5812; Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE... IF IT'S

Westinghouse



FOR EVERYTHING ELECTRICAL..

Presenting the

NEW NATIONAL ELECTRIC XDUCT CONDUITS!

They're new on the inside . . .
new on the outside!

Here's what these new conduits mean to you!

1. EASY FISHING—"Xduct's" new baked-on inside coating of aluminum enamel (patent applied for) was developed through intensive research in connection with important government projects. It provides minimum friction between conduit wall and wires. The result: Actual fishing tests conducted with five other leading brands of conduit prove "Xduct" is 66% easier to fish on constant pull—more than twice as easy to start.

2. SUPERIOR CORROSION RESISTANCE—National Electric's revolutionary new patented electrogalvanizing process electrolytically deposits pure zinc uniformly over the entire outside surface of "Xduct" conduit, including the threads. The result: a protective coating that adheres positively to the basic steel . . . possesses superior corrosion resisting qualities.

3. THREAD PROTECTION—Sharp, clean threads of "Xduct" rigid steel conduit are machined before galvanizing to assure complete protection from end to end. The result: every hill and valley of threads are completely galvanized.

4. SUPERIOR BENDING—High-ductile steel is used to assure easy bending.

5. DESIRABLE COLOR—"Xduct's" silvery color is highly acceptable for installation in exposed locations.

Fishing is easy with
"XDUCT" CONDUIT
Proved best by actual test

EVERYTHING IN WIRING POINTS TO

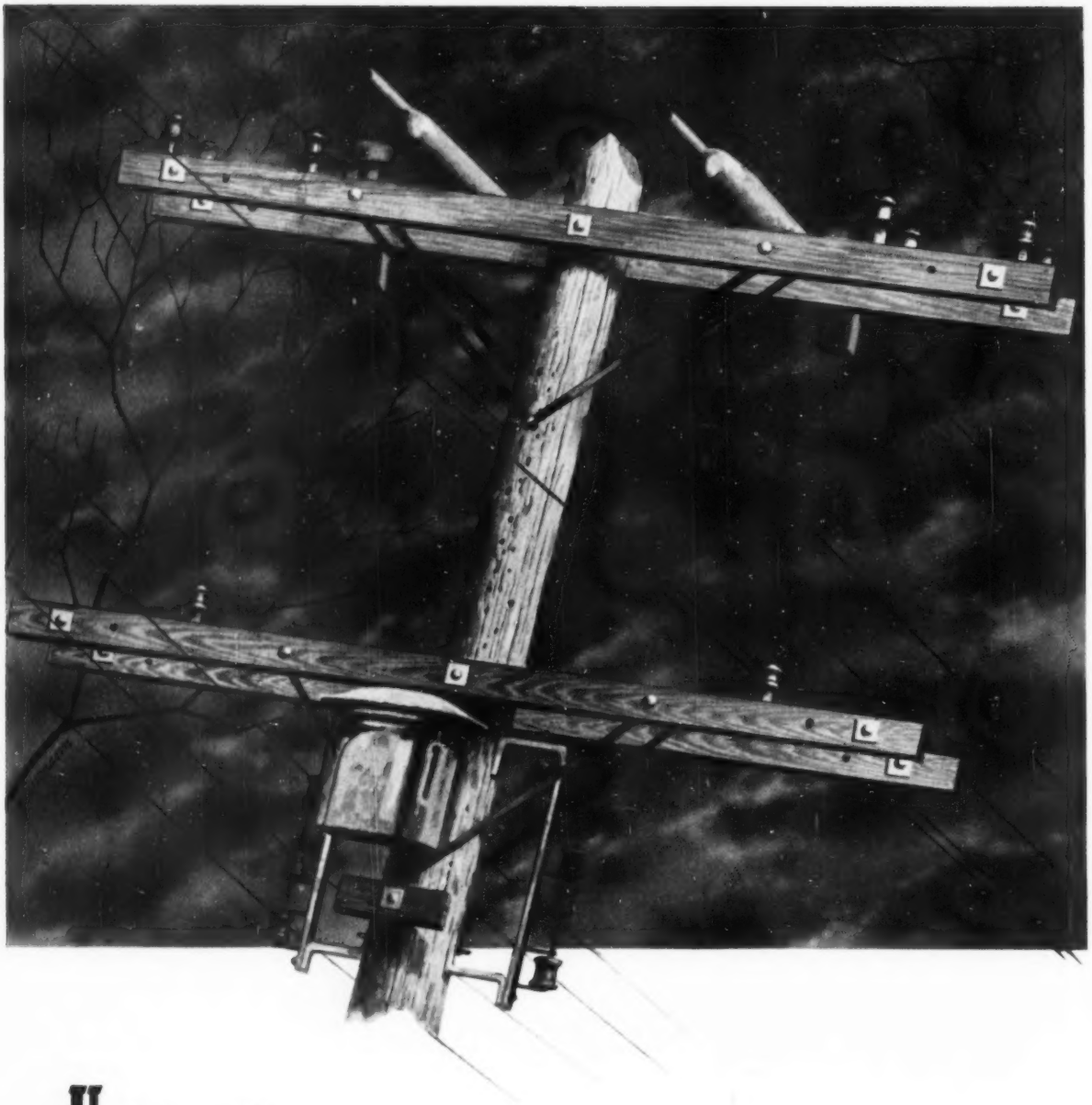
National Electric Products

PITTSBURGH, PA.

3 Plants • 7 Warehouses • 34 Sales Offices

LISTED BY UNDERWRITERS' LABORATORIES, INC. • STOCKED BY LEADING ELECTRICAL WHOLESALERS EVERYWHERE

. . . CALL WESCO



Uniting all of America's voices

Come hail or high water, the nation takes for granted its electric lines that are lifelines of communication, comfort and convenience.

For those lifelines are *secured* with pole line materials made by Oliver Iron and Steel. Tough, tireless sentinels, they're made to outwit both weather and the attacks of time — keeping *united* all of America's voices, electric energy and electrifying enterprise.

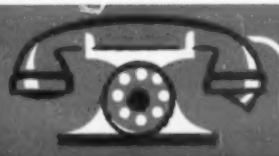
Wherever electric lines are strung, assembly lines move, steel buildings rise, trains roll or ships sail — Oliver fasteners and pole line materials are there defying the stresses of time and wear.

Oliver pole line materials are available in most areas through local Westinghouse Electric Supply Company distributors.

OLIVER Iron and Steel Corporation

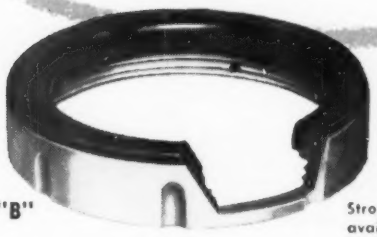
Industrial Fasteners • Pole Line Materials • Berry Hydraulics

PITTSBURGH PENNSYLVANIA



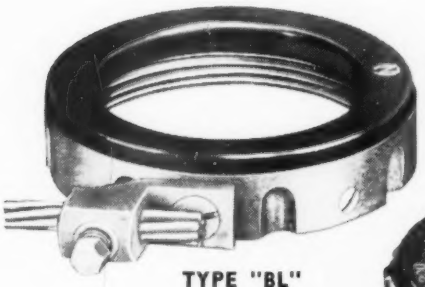
FOR EVERYTHING ELECTRICAL . .

THERE'S AN O.Z. BUSHING FOR EVERY JOB



TYPE "B"

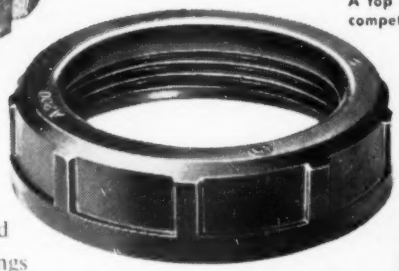
Strongest insulating bushing available! Exclusive design permanently locks insulation into casting.



TYPE "BL"

Same as proven Type "B" with lug for quick, positive ground connections. Set screw in casting facilitates positioning.

Finest, high-strength, all-Bakelite insulating bushing. A top quality bushing—competitively priced!



TYPE "A"

All-Bakelite bushing with male thread for insulation of exposed cables passing through holes in metal boxes or troughs.

TYPE "BB"

Over 35 years of specialized experience in the design and manufacture of conduit fittings is behind the complete line of O.Z. insulating bushings. Whatever your insulating bushing problem, you can be sure there is an O.Z. design to fit your application perfectly. Buy O.Z. bushings from your local electrical distributor.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 2, N. Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

Representatives in all principal cities

. . . CALL **WESCO**

FOR A TOUGHER FASTER AND NEATER JOB!

PLYMOUTH PLASTIC Electrical TAPE

TOUGHER

FASTER

NEATER

FOR FINEST OF PLASTIC TAPES

For the neatest job, for the biggest savings in time and money, Plymouth Plastic Electrical Tape is your best buy every time!

MORE PROTECTIVE: Seven solid mils of high dielectric vinyl provide 16% more dielectric and mechanical protection.

MORE PRACTICAL: It saves space and gives more effective protection.

MORE ECONOMICAL: Greater flexibility and stretch make each roll go farther. Does the work of both rubber and friction tape, saving time and money.

Packed individually — one 66-ft. roll, ¾" wide in single pocket size metal can or the convenient 5-pack container with five 30-ft. rolls ¾" wide.

PLYMOUTH RUBBER COMPANY, INC.

Established in 1896

CANTON, MASSACHUSETTS

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For You

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HIGH VOLTAGE DIVISION PLANT
PARKERSBURG, WEST VIRGINIA

Porcelain Products
New Improved Production Facilities
Transmission and Distribution Insulators and Fittings

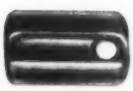
No. 66200–6"–10,000 lb. M & E—dated, performance tested distribution strain insulators. Quality controlled.

No. 6198N distribution pintype. Type "N" glaze eliminates radio and television interference developing at the insulator—available on all pintypes, new large wire grooves.

A RUGGED Work-horse ON *DEAD-ENDS*

INCOMPARABLE *TYPE "N" GLAZE*

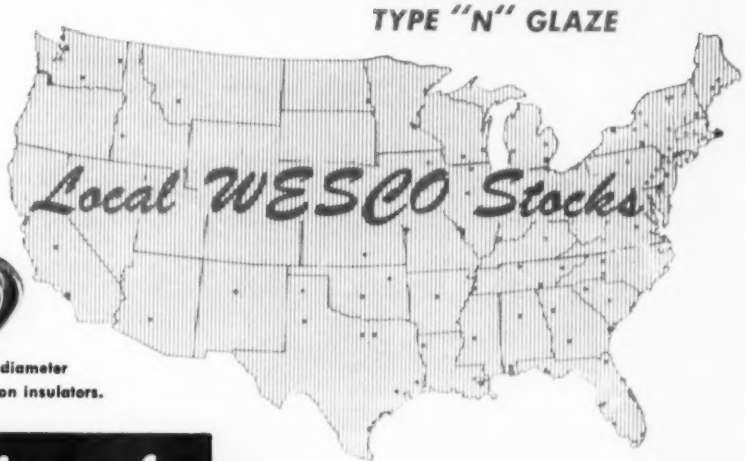
Transmission and distribution fittings.



Guy Strain Insulators

Wet Process Spools

10" diameter suspension insulators.



Porcelain Products, Inc.
PARKERSBURG, W. VA.

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230°F
IT'S THE A.V.C. CONSTRUCTION THAT MAKES THE DIFFERENCE
OUTER FELTED ASBESTOS WALL
VARNISHED CAMBRIC
INNER FELTED ASBESTOS WALL
You can get life-long dependable service under severe operating conditions because these walls of impregnated felted asbestos permanently resist heat and moisture, mechanical damage and effectively seal the high dielectric varnished cambric tapes from deterioration.

ROCKBESTOS A.V.C.® (N.E.C. TYPE AVA)

PREVENTS WIRE FAILURES... CUTS MAINTENANCE COSTS WHERE TEMPERATURES RUN HIGH

Get started on a failure-prevention campaign if you want to avoid future trouble in your power, control and lighting circuits. Look into all possible trouble-sources such as high ambient temperatures, probable overloads, exposure to moisture, oil, grease and corrosive fumes . . . then specify Rockbestos A.V.C., (AVA) the wire designed to meet these conditions.

These permanently insulated wires and cables guarantee long and trouble-free service in circuits exposed to severe operating conditions because they have an impregnated asbestos insulation that is heat and flame resistant. It won't bake brittle, crack or flow in temperatures up to 230°F . . . and won't deteriorate with age or rot when exposed to oil, grease or fumes.

Protect "hot-spot" circuits around boilers, furnaces, kilns, soaking pits, pump rooms, steam tunnels and heat-exposed ducts with Rockbestos A.V.C. (AVA). It will eliminate re-wiring jobs and expensive maintenance. 125 different standard types are available in 600 to 5000 volt ratings.

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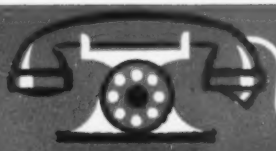
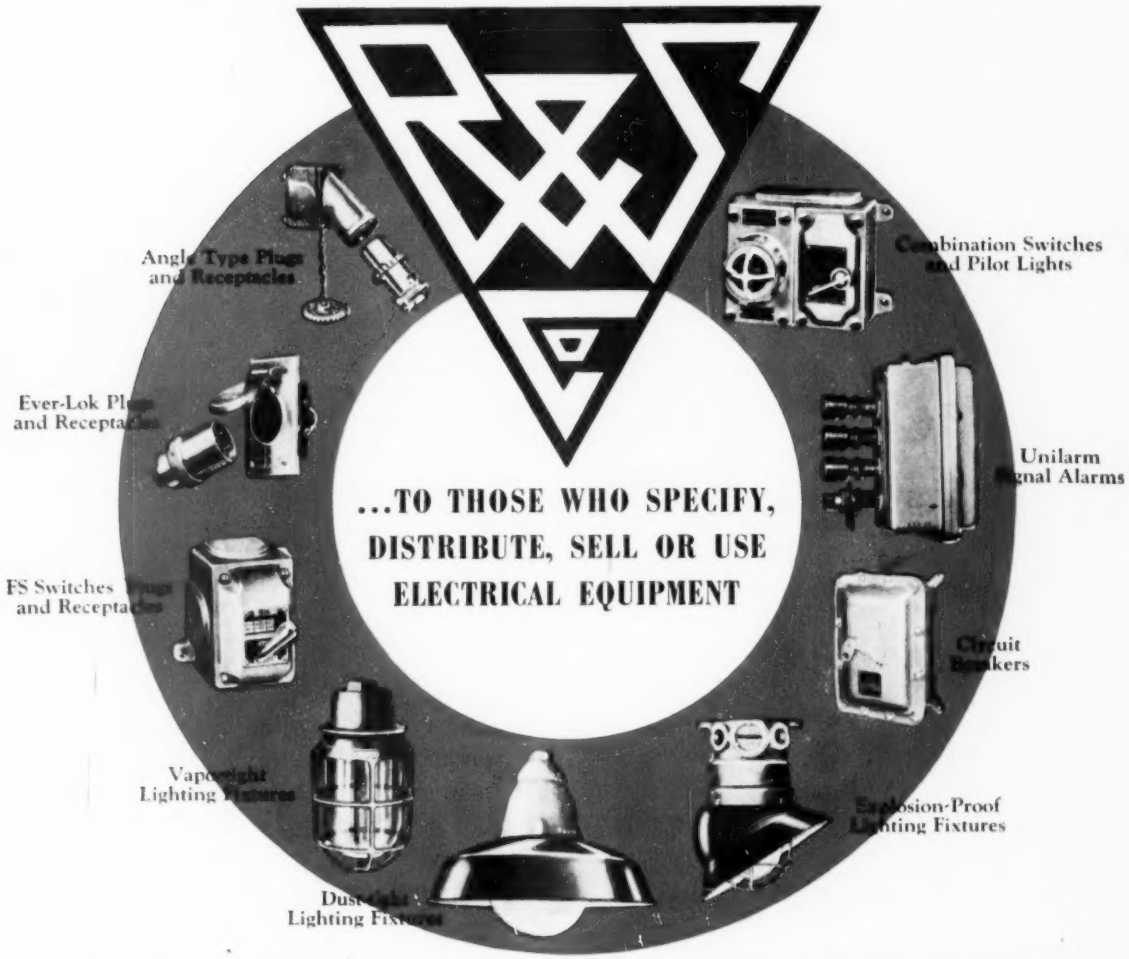


FOR EVERYTHING ELECTRICAL . .

SYMBOL OF OUTSTANDING QUALITY


Angle Type Plugs and Receptacles
Combination Switches and Pilot Lights
Ever-Lok Plugs and Receptacles
Unilarm Signal Alarms
...TO THOSE WHO SPECIFY, DISTRIBUTE, SELL OR USE ELECTRICAL EQUIPMENT
FS Switches Plugs and Receptacles
Circuit Breakers
Vaporight Lighting Fixtures
Explosion-Proof Lighting Fixtures
Dust-tight Lighting Fixtures

Many electrical equipment items today look quite similar, have standardized ratings and specifications . . . but there is one important variable of value — QUALITY!

More and more, engineers, architects and others concerned with specifying electrical equipment, write "R & S Quality" into specifications. Increased numbers of contractors, electricians, distributors and others who sell R & S quality at the point of sale, see convincing evidence of its effect on customer satisfaction and repeat business. Industry, as the user of over 5000 R & S electrical equipment items, has discovered that this quality means complete electrical dependability and long service life.

All these advantages are symbolized by this well-known Russell and Stoll registered trade-mark. It is emblematic of over 50 years of specialized experience, sound engineering design, finest materials and precision manufacture.

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RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

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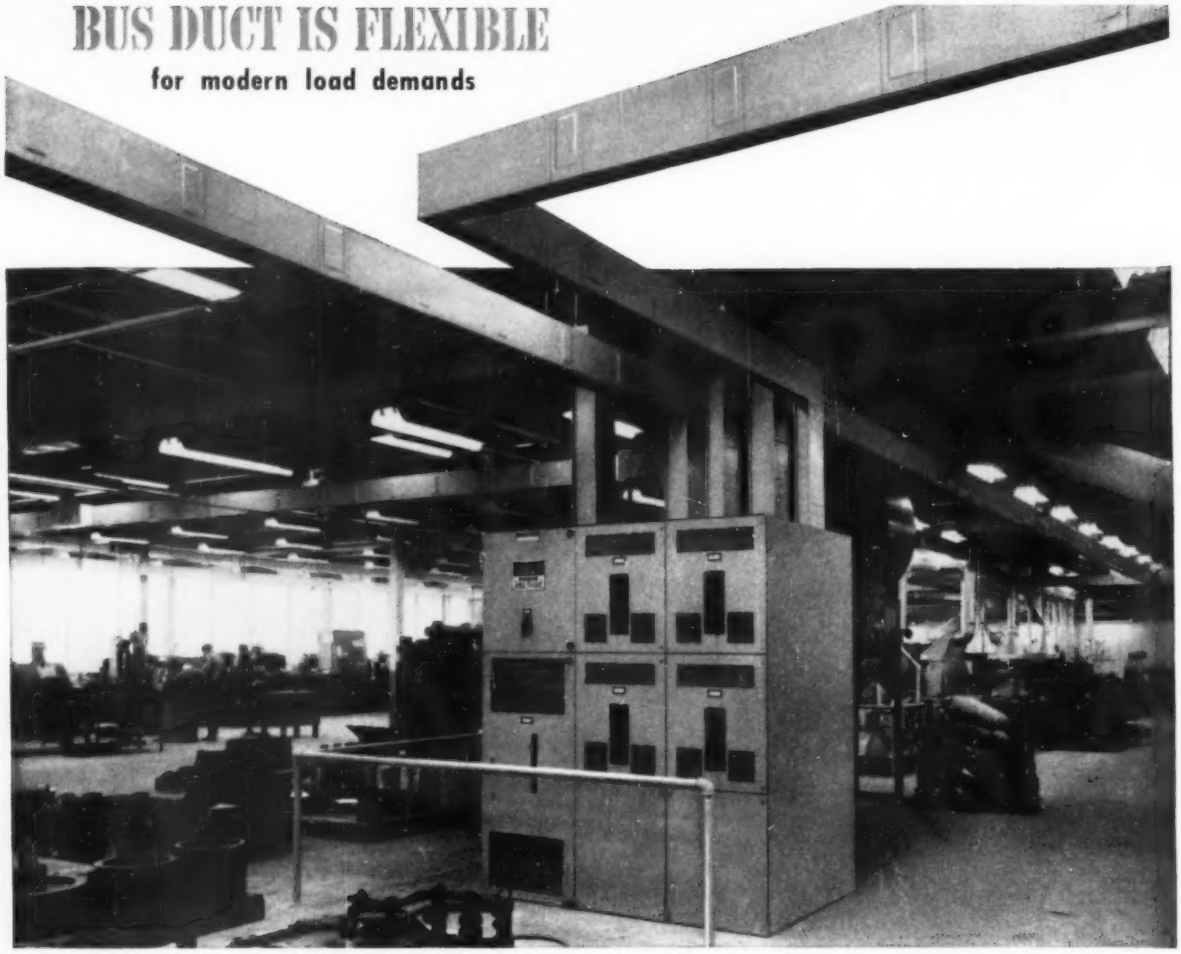
BUS DUCT IS FLEXIBLE

for modern load demands



BUS DUCT solves concentrated load demands at Besly-Welles Corporation

Manufacturing areas packed with machine tools dictated the choice of bus duct for the new plant of the Besly-Welles Corporation at South Beloit, Illinois. Westinghouse Plug-in Duct provides power availability at one-foot intervals . . . enables machines to be tied in fast . . . permits complete flexibility and minimum production loss when relocating machines.

This job is typical of most Westinghouse Bus Duct installations—it costs less to install. It is engineered to fit the plant layout. Standard sections are pre-assembled and hung easily with sliding cantilever hangers. Duct is out of the way—yet every foot is accessible.

For today's—and tomorrow's—industrial load demands, Westinghouse Bus Duct is ideal. Up to 5000 amperes, it packs more power into smaller space than any other type of power distribution. It's completely salvageable—can be readily dismantled, reassembled, expanded. Four types available for any distribution need.

For the full story, see your Westinghouse Distributor, or write for B-5835, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-30168

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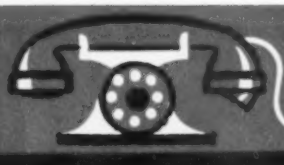
Westinghouse

APPARATUS DISTRIBUTOR



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WHAT DO YOU NEED IN A TIME SWITCH?

Short OFF Periods?

If your application needs a minimum OFF period as low as 30 minutes Sangamo can furnish a switch with reversed time limits, so that the minimum OFF period is considerably shorter than the minimum ON period.

Omitting Devices?

Your Sangamo time switch can omit one or more days of repetitive operation from a weekly schedule for applications where factories are closed on Sunday, on week-ends, or on any other days of the week.

Advance Time Control?

If you need an earlier than normal start on some special operation, Sangamo can furnish an auxiliary control to provide an early ON operation on any given day or days of the week.

Synchronous Carryover?

When equipped with the carryover, Sangamo Time Switches keep right on running—even when the electric power fails. An electrically wound main spring automatically takes over until power is restored. It provides up to 10 hours of reserve operation.

Sun Time Operation?

The famous Sangamo Astronomic Dial functions automatically to control daily time switch operation in accordance with the time of sunset and sunrise, compensating daily for the changing seasons. No periodic manual resetting is required.

Sangamo has the answer..!

If you need time switches for the simplest single ON and OFF operation, or for complex weekly schedules, Sangamo can fit your exact needs from the complete line with special control features.

All Sangamo Heavy-Duty Time Switches are built to provide an *extra* margin of dependability, and all have these features:

LOW-SPEED MOTOR

The exclusive Sangamo built low-speed low loss motor (450 R.P.M.) means less bearing wear, and, consequently more years of service.

LIFETIME LUBRICATION

A special silicone grease assures perfect operation in a temperature range from 50 degree F. below zero to 200 degree F. above. No special motor coils are required even in the coldest climates.

OVERSIZE SILVER CONTACTS

The pure silver contacts are very conservatively rated and minimize troublesome arcing by combining a slow break action with a small gap.

MACHINE-CUT GEARS

The heavy gears are precision made. They transmit the power to the dial smoothly and possess strength in excess of any service requirements.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Get the full story . . . Write for Catalog No. 1010-A

ST52-8

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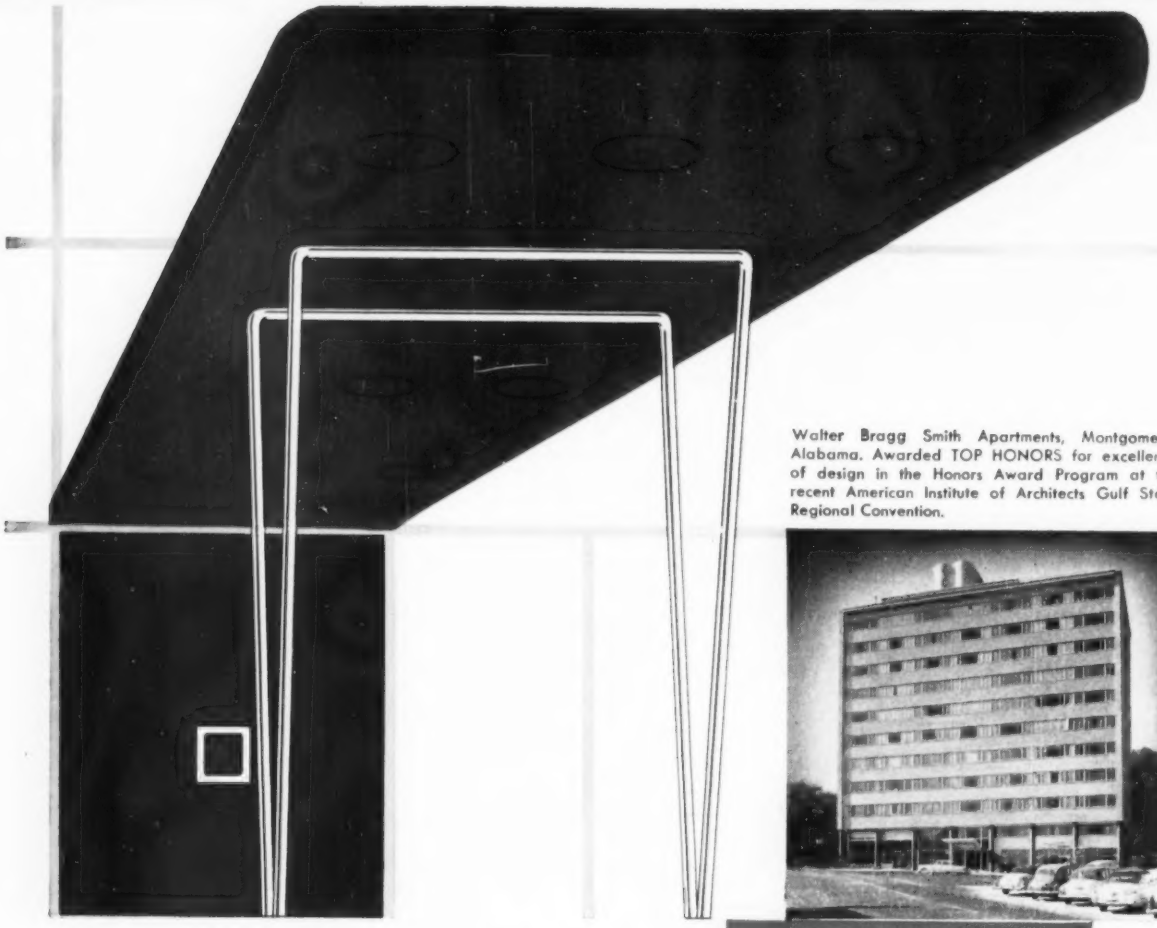

Walter Bragg Smith Apartments, Montgomery, Alabama. Awarded TOP HONORS for excellence of design in the Honors Award Program at the recent American Institute of Architects Gulf State Regional Convention.

SPANG "CENLACO"... a modern design conduit for a modern design building

"The materials going into this building were very carefully selected, based on the partners' years of experience, for we realize that a building is no better than the materials which form its component parts."

—Richard J. Adams, *Sherlock, Smith & Adams*

That's why SPANG Cenlaco Conduit was used exclusively for this "TOP HONORS" building and, as Mr. Adams stated, "played such an important part in making this an outstanding building."

Here again is evidence of the reliance that prominent owners, contractors and architects place on the uniformity and dependability of SPANG Cenlaco Conduit.

SPANG Conduit, made from top-grade steel, is quality-controlled during forming, made under the most exacting conditions, and thoroughly inspected to assure you of a dependable product with a built-in lifetime of service.

SPANG Conduit is easier to bend, cut and thread, saving you time and money on installations. Your local distributor carries SPANG's complete line of conduit . . . "Cenlaco," "Central White," "Central Black," and SPANG EMT with the SPANGLEAM finish. No matter what your wiring requirements are, be sure to specify SPANG.

OWNER
Montgomery Towers, Inc., Montgomery, Alabama

ARCHITECTS
Sherlock, Smith & Adams, Montgomery, Alabama

GENERAL CONTRACTOR
Bear Brothers, Montgomery, Alabama

ELECTRICAL CONTRACTOR
Long-McGee Electrical Company, Montgomery, Ala.

DISTRIBUTING JOBBER
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SPANG-CHALFANT
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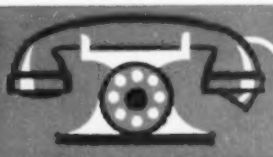

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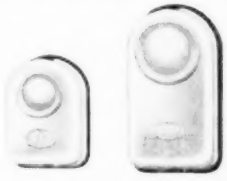
the Emblem of Quality since 1875

Electrical Signals and Systems

UNIPACT SIGNALS. Need one—or a series of bells, chimes, buzzers or horns? You can have your choice, because these various types of signals are interchangeable; no new wiring is needed. UNI-PACT Signals meet noise level requirements with tailor-made results.

FARADAY FIRE SYSTEMS. FARADAY Fire Alarms provide *extra* protection. A wide variety of systems to meet all fire warning requirements. Models available for surface or semi-flush installations. FARADAY is known for dependability throughout the industry.

FARADAY CLOCKS. Can be furnished for remote control by master units, or for direct-operating installations. FARADAY models are supplied for either surface or flush mounting, in 10, 12, 15 and 18 inch sizes. Easy-to read dials are white, with bold Arabic numerals.



FARADAY BELLS AND BUZZERS. A complete selection of both bells and buzzers for homes, offices, hotels and apartment buildings. Attractive appearance . . . long-lasting. Years of research and production experience make FARADAY signals the outstanding brand—always dependable.

CONSULT YOUR ELECTRICAL WHOLESALER FOR COMPLETE DETAILS.

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BELLS • BUZZERS • HORNS • CHIMES • VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

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Fifty Years of Saving Minutes

for Contractors

Minutes that are ever increasing in value
Today they are quoted around 60¢ per dozen

"Make boxes and conduit fittings that will not only do a better job but save installation time."

That was the aim of the founder of Steel City Electric Company, who had been both an electrician and a contractor, and down through almost fifty years that aim has been followed.

Easy-to-remove knockouts . . . brackets, ears and nailholes for most convenient mounting . . . clamps providing free access and positive clamping of wires . . . screws staked to prevent falling out during transit have combined to save time in installing Steel City boxes.

Careful designing . . . accurate machining . . . smooth-running threads have been a ***must*** for connectors, couplings and other conduit fittings, saving high-cost minutes.

. . . and, careful inspection along all production lines and before packing insure against any defective product reaching the job.

Another Minute Saver Is This Book . . .

That pictures and describes in detail the boxes in Steel City's complete line. Copies on request.

STEEL CITY ELECTRIC CO.
1207 Columbus Avenue
PITTSBURGH 33, PA.

The Pivot Point of Minute Saving

Steel City Leads in Meeting Contractors' Needs . . .
—because Steel City Boxes Help Electricians . . .

Do Better Jobs Quicker

FOR EVERYTHING ELECTRICAL . .

Electrical Contractors!

SALES AND REFERENCE KITS

...ARE ONCE AGAIN AVAILABLE IN LIMITED QUANTITIES

Only $2.75 with famous Westinghouse Lighting Handbook. This book alone sells for $2.00! Without Handbook, kit costs $1.50.

If you failed to get your kit because you missed our last offer . . . or because we ran out of kits . . . contact your local Westinghouse Lamp Sales Office, or mail the coupon below today!

This kit helps you figure installations. It contains the latest lighting developments and special forms to layout installations. There's also a complete direct mail campaign for your use, plus a slide rule, and special Incandescent Lamp Characteristic Calculator. In short, you get a complete lighting contractor's office that fits under your arm.

And for $2.75 it includes the famous Westinghouse Lighting Handbook. Everyone who sees the handbook seems to think it's the most complete lighting text in the field. Order yours today by calling your local Westinghouse office, or mailing the coupon below.

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WESTINGHOUSE LAMP DIVISION, DEPT. EC-11
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Enclosed find $_____ for _____ copies of your New Westinghouse Sales and Reference Kit with Handbook ($2.75) ☐ without Handbook ($1.50) ☐

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CITY_____ ZONE_____ STATE_____

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PLUGMOLD 2000 *is the EASIEST, FASTEST, CHEAPEST way to provide MULTIPLE CONVENIENCE OUTLETS!*

All over the country, installations of Plugmold 2000 in factories, offices, hospitals, stores, homes — in every type of building, new and old—have demonstrated this fact: you can provide the multiple outlets that everybody wants, more easily, more quickly and at less cost with Plugmold 2000.

Plugmold 2000 is easily mounted on any surface. You install it in one long, continuous run — no multiple connections of a lot of short lengths! You can feed into the Plugmold 2000 raceway at any convenient point — there are ½" knock-outs for feeding every 7½" — no special fitting is needed; all you need is any standard squeeze connector for armored cable.

Plugmold 2000 provides a duplex or a NEMA grounded outlet every 30 inches. 18", 6" and even closer spacings in clusters, are available in factory-wired sections. Duplex receptacles are available with both sides "hot", or with one side "hot" and one side switched.

WIREMOLD

Makers of
PLUGMOLD—multi-outlet systems
WIREMOLD—electrical raceways
PANCAKE—overfloor raceways

It's a fact!

PLUGMOLD 2000

- builds *better* business for contractors!
- makes any building a *better* building!
- makes production lines *more efficient* by making power tools more readily available!

FACTORIES

OFFICES

STORES

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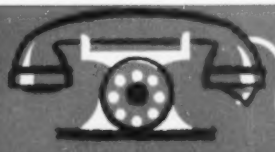
HOMES

WRITE TODAY for Plugmold 2000 booklet and complete installation instructions.

THE WIREMOLD COMPANY Hartford 10, Conn.

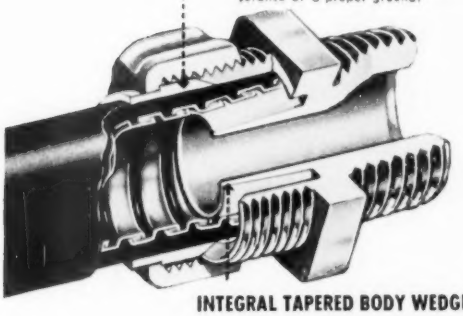


FOR EVERYTHING ELECTRICAL . .

NOW... keep wiring really liquid-tight with *NEW* T&B Connectors for liquid-tight flexible metal conduit

PLASTIC GRIPPING RING

- Seamless, pliable, oilproof plastic forms perfect seal with plastic conduit sheath.
- Protects conduit sheath against damage.
- Blue color gives visual installed insurance of a proper ground.



INTEGRAL TAPERED BODY WEDGE

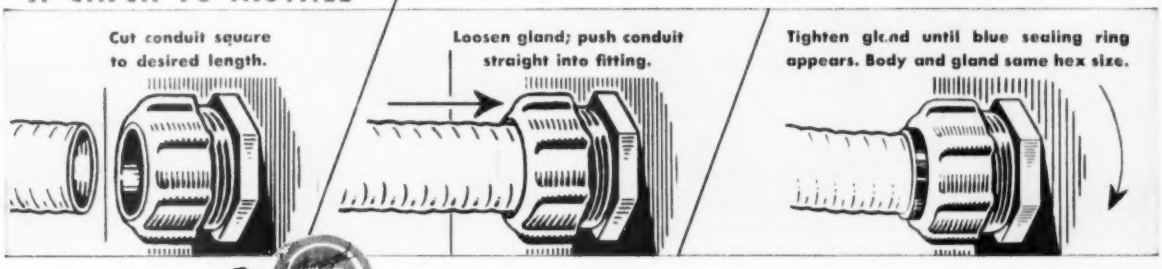
- Positive ground for metal conduit armor.
- Fits all thicknesses and convolutions in standard liquid-tight flexible metal conduit.
- Grounding member integral with body.

Seal out all moisture, oil, and corrosive fluids with this easy-to-install, self-grounding connector . . . a connector specially designed by Thomas & Betts for liquid-tight flexible metal conduit.

Just push conduit into connector body and take up on gland nut until blue plastic ring appears. No need to disassemble connector. No twisting of conduit. Same wrench fits both body and gland.

Integral tapered body wedge positively grounds metal conduit armor. Plastic-to-plastic seal between gripping ring and conduit jacket makes tight leakproof connection. Straight connectors, 45° and 90° elbows available for conduit from ¾" to 2".

A CINCH TO INSTALL—


Cut conduit square to desired length.
Loosen gland; push conduit straight into fitting.
Tighten gland until blue sealing ring appears. Body and gland same hex size.

LOOK FOR THIS SIGN — ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T327

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34 Butler Street • Elizabeth 1, New Jersey

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MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

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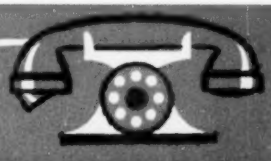

This complete AB-I Circuit Breaker line

solves more of your customers' problems— means more sales protection for you

Here's how to line up bigger circuit breaker sales—with the complete line of Westinghouse AB-I Circuit Breakers.

As shown above, there's an AB-I Breaker for *every* operating condition—indoors and outdoors, in wet and dusty locations, in explosive or corrosive vapors and dusts. Solving any application problem is merely a matter of selecting the right NEMA enclosure. Ends shopping around for "specials"—enables you to bid on jobs you couldn't handle formerly.

AB-I's solve many customer problems. They reduce downtime as much as 98%* compared with fused devices—eliminate dangerous fuse bridging, too. They save on maintenance—no replacement parts needed. They end unnecessary power outages with inverse-time-delay tripping action. And they protect workmen from live parts and costly accidents.

Certainly, AB-I Circuit Breakers can do a lot for your customers—and you! For complete information call your Westinghouse Representative or write for B-5456, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

*Name of company on request

J-30142

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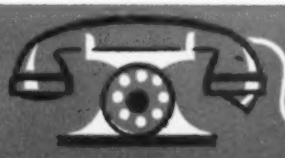

FOR EVERYTHING ELECTRICAL . .

USED FOR THEIR
QUALITY
Across the Country

WAGNER Malleable Electrical Fittings are tough, accurately cast, precision threaded, perfectly finished and quality inspected. Every step in their production is done in our own foundry under complete chemical laboratory control.

There never is a variance in the quality whether a few or many of one kind is ordered.

FROM MOLTEN METAL TO FINISHED PRODUCT

WAGNER MALLEABLE PRODUCTS COMPANY

222 W. Adams St. Chicago 6, Illinois
Foundry and Plant Decatur 60, Illinois

WAGNER MALLEABLE FITTINGS

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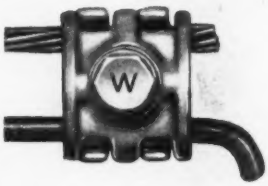
designed by men who know your job...

...the **WEAVER LINE**

SERVICE ENTRANCE HEADS

HOT LINE CLAMP

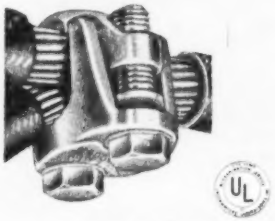
BONDED COPPER GROUND ROD



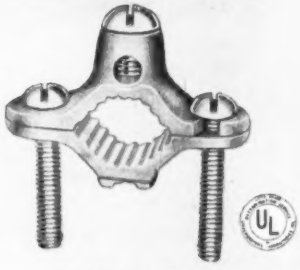
JUMPER CLAMP

POLE BOTTOM GROUND PLATE

GROUND ROD CLAMP



HEAVY DUTY CONNECTORS



GROUND CLAMP

RESULTS:

- *easier installation,*
- *longer service life,*
- *lower costs!*

The new WEAVER Service Entrance Heads have an all-purpose connector clamp built-in. The same head fits EMT or rigid conduit without extra fittings.

WEAVER Ground Rods are copper armored from tip to tip . . . pole bottom plates have 25% more copper area than provided by others.

WEAVER Ground Clamps are cast of *bronze* . . . can't rust or corrode. The swinging top cuts installation time. Priced lower than other leading clamps!

WEAVER Heavy Duty Connectors are built of high strength electro-bronze. They give you high pressure connections that can't vibrate loose. Easy to install and tape. Priced far lower than split-bolt connectors . . . you save up to 30% on larger sizes!

ALL ITEMS STOCKED BY YOUR LOCAL WESCO BRANCH

J. A. WEAVER *Company*

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FOR EVERYTHING ELECTRICAL . .

"Get cleaner threads, tighter joints with Buckeye Conduit!"

AN ELECTRICIAN TALKS ABOUT CONDUIT: "I agree with other electricians that "Buckeye" gives a clean and strong thread. A clean thread is essential for making a really tight, safe joint! Youngstown rigid steel conduit is tops."

ELECTRICAL ENGINEER ENDORSES BUCKEYE CONDUIT: "As an electrical engineer, I have jobs which demand wiring which must withstand vibrations and shock. By specifying "Buckeye" I protect these wires because only good steel produces threads strong enough to make tight and safe joints."

Youngstown makes rigid electrical conduit from start to finish. This enables Youngstown to control the complete manufacturing process which insures that each length of "Buckeye" is made of topgrade steel. Since only high quality steel produces a clean, strong thread, it's no wonder that "Buckeye" is a favorite in the industry. On your next job, be sure to specify Youngstown Buckeye conduit.

Shipments of Buckeye rigid steel conduit are now being made from our conduit mills at Indiana Harbor and Youngstown.

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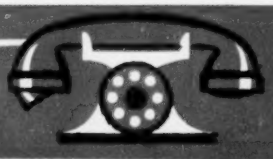

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Practical Methods

HYDRAULIC JACK on H-frame provides pressure to electric drill assembly when holes are cut in concrete walls or floors. Mechanic steadies drill handle against rig while applying pressure with jack handle. Unit can be placed upright for vertical drilling.

Adjustable Drilling Frame Uses Hydraulic Pressure

CONSTRUCTION

The speed and operational economy of masonry drills are causing a change in cutting techniques used in the electrical construction field. Since a substantial part of this cutting is involved in remodeling projects on existing structures during tenant occupancy, noise is a critical consideration. The old bull point and sledge hammer are slow and noisy. The chatter of air hammers, and even electric hammers, is objectionable in most cases. Field experience seems to indicate that drilling is one answer to the problem. Electrical contractors are now using a variety of masonry drills to cut holes in concrete floors and walls for passage of conduits, bus ducts and other raceways.

Efficiency in masonry drilling depends upon the type of aggregate being cut, type of cutting edge on the drill, speed of the drill and pressure applied during the drilling operation. Drill manufacturers recommend applied pressures ranging from 500 to 2,000 pounds depending upon the required size of drill and opening. They also suggest the use of the lever and jack principle to secure this directional force.

Since it is frequently difficult to set up an adequate lever system for standard electric drills in the field, Continental Electrical Construction Co., Chicago, prefers hydraulic jacks. Continental engineers designed and constructed an adjustable steel frame to support the drill-jack assembly.

The H-frame is constructed of two-6-inch steel channel uprights, each 62 inches long. The adjustable cross-piece is fabricated from two 24-inch lengths of 4-inch channel mounted back-to-back with suitable spacers and flange end plates. Three bolt holes in each flange plate match holes in the 6-inch uprights for vertical adjustment. A "rail" arrangement on the underside of the cross-piece seats the jack adjusting screw plate; permits lateral movement of the drill assembly so up to four 3-inch diameter holes can be drilled side-by-side without relocating the H-frame.

A 3-ton hydraulic jack provides the drilling pressure. Its base is bolted to the housing of a standard 1¼-inch, 250 rpm, heavy duty electric drill. The H-frame is anchored to the floor or wall with two ½-inch bolts and shields. During the drilling operation, the electric drill handle is steadied against the 6-inch channel upright with one hand, while the other pumps the hydraulic jack handle to provide the necessary pressure.

For horizontal drilling, the frame is supported on four conduit legs as shown in the accompanying photograph. These "legs" are held securely by threaded hubs welded to the frame and vary in length depending upon elevation of holes being cut in the wall. When the frame is used for vertical drilling, the pipe legs are removed.

Electrical control and connection is provided by a clamp-on switch box containing a standard toggle-type motor switch with thermal overload protection and two receptacles—one female for the drill cord and one male for an extension cord connection.

Continental's field engineers like the economies provided by this drilling rig and the mechanics who operate the unit are especially fond of the operating ease.

Care And Protection Of Truck Batteries

INDUSTRIAL

Preventive maintenance of electric industrial truck storage batteries can be reduced to an economical and systematic plan for proper care and protection. Such a plan can be established on the basis of a checklist which is easily suited to the particular requirements of a plant depending upon the amount of equipment to be cared for, the personnel concerned with maintenance and the maintenance budget. Charles H. Greener, general service manager of the Automatic Transportation Company, Chicago manufacturer of electrically driven industrial trucks, developed the following checklist of 11 precautions which add extra life to batteries and reduce the purchase of new batteries:

Keep filler caps closed; open only for filling.

Keep batteries clean and dry externally.

Keep electrolyte at proper level at all times.

Keep batteries on a suitable charging schedule.

Do *not* connect an ammeter across the battery terminals to test cell connections.

Do *not* leave a battery in a discharged condition.

Do *not* bring an open flame close to a charged battery or battery vents.

Do *not* permit a battery to overheat during charging.

Do *not* add water to the acid; add acid to the water.

Do *not* lay tools or pieces of metal on a battery.

Do *not* overfill battery cells.

SORGEL AIR-COOLED Dry-Type TRANSFORMERS

Top Quality Time Tested

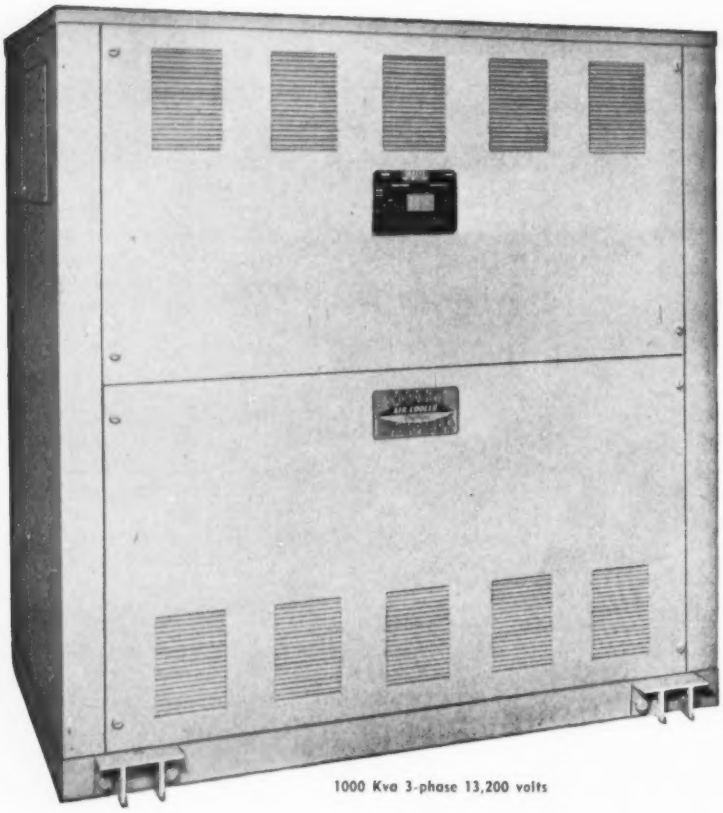
SORGEL dry-type transformers are preferred because of their cost-saving features and years of dependable service.

Easy installation—
Attached mounting brackets.

Easy connecting—
Roomy connection compartment with solderless terminals.

Rugged construction—
Totally enclosed in steel.

Liberal design—
High efficiency.
Low noise level.



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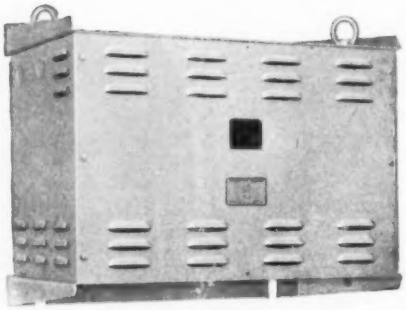
Complete Line

¼ Kva to 1500 Kva single phase.
1 Kva to 3000 Kva 3-phase, 2-phase and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, up to 15,000 volts, and any intermediate or special lower voltages.

¼ Kva single phase 480/240 to 240/120 volts



20 to 50 Kva 3-phase. Wall mounting type.

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Portable Panel for Temporary Distribution

CONSTRUCTION

On many electrical construction projects, contractors face the necessity of providing temporary distribution facilities. This problem is inherent with most electrical rehabilitation work where plant operation and production must be maintained while a portion of the electrical system is being revamped.

There are a number of methods of providing such facilities. Some contractors erect a temporary board of wood uprights and wood or plywood face on which a group of disconnect switches are mounted. Others use angle iron or continuous channel framing to support the switches. Instead of erecting a free-standing assembly, still other contractors mount temporary switches on a convenient wall. Methods vary with the specific job conditions and the individual contractor's established field techniques.

Electrical Contractors, Inc., Chicago, found a completely assembled, metal enclosed, portable distribution panel best suited to their specific requirements. They designed and constructed a unit which is kept available in their storage yard and ready for dispatch to a job on a moment's notice. Main switch capacity and number and size of branch circuit fuse clips were chosen to meet average job requirements determined by past experience.

The portable cabinet is fabricated from ⅛-inch thick sheet steel; is 68 inches high, 50 inches wide and 22 inches deep; has double, full-length, flanged, hinged doors on front with padlock facilities; is mounted on four large full-swing casters. Full-length, 9-inch wide hinged doors on each side provide branch circuit and feeder cable access for back-of-panel connections.

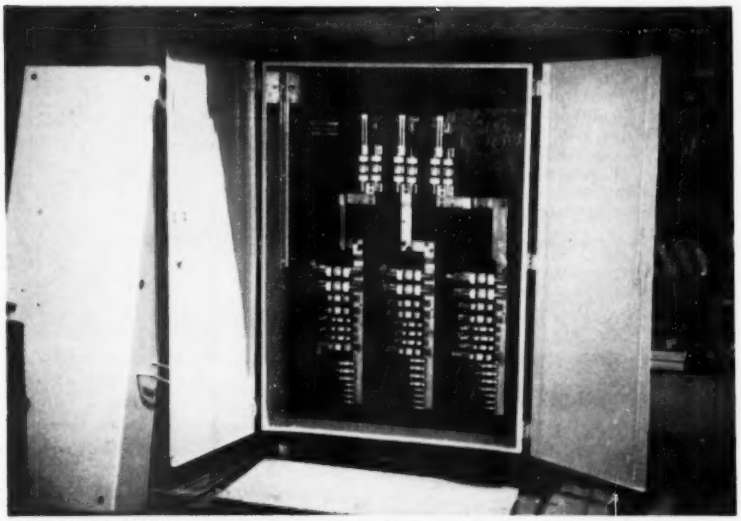
The distribution board consists of a plywood panel (fastened to angle-iron supports by six bolts) on which are mounted a three-pole, 800-ampere (double fuse) main knife switch and bus work to serve fuse clips for the following three-phase circuits:

2—400-ampere circuits
3—200-ampere circuits
3—100-ampere circuits
4— 60-ampere circuits
3— 30-ampere circuits

While normally used with back connections, the board can be easily altered for front connection of branch circuit cables, if desired.

Electrical Contractors, Inc., estimators and engineers like the tremendous time-saving features of this portable panel. When needed, the unit is quickly trucked to the job and easily rolled into place. There is no time expended in building a temporary board and handling and mounting numerous disconnect switches. Circuit connections can be made immediately when the board is in place. The unit can be moved from area to area in a plant if necessary as system rehabilitation progresses. And when the job is complete, the temporary distribution panel is 100% salvable.

COVERED CONDUIT STALLS line the exterior truck drive of the T. L. Rosenberg Company headquarters in Oakland, California. Outdoor storage scheme requires a minimum of ground area, facilitates conduit handling and releases valuable indoor space to shop and equipment repair operations.



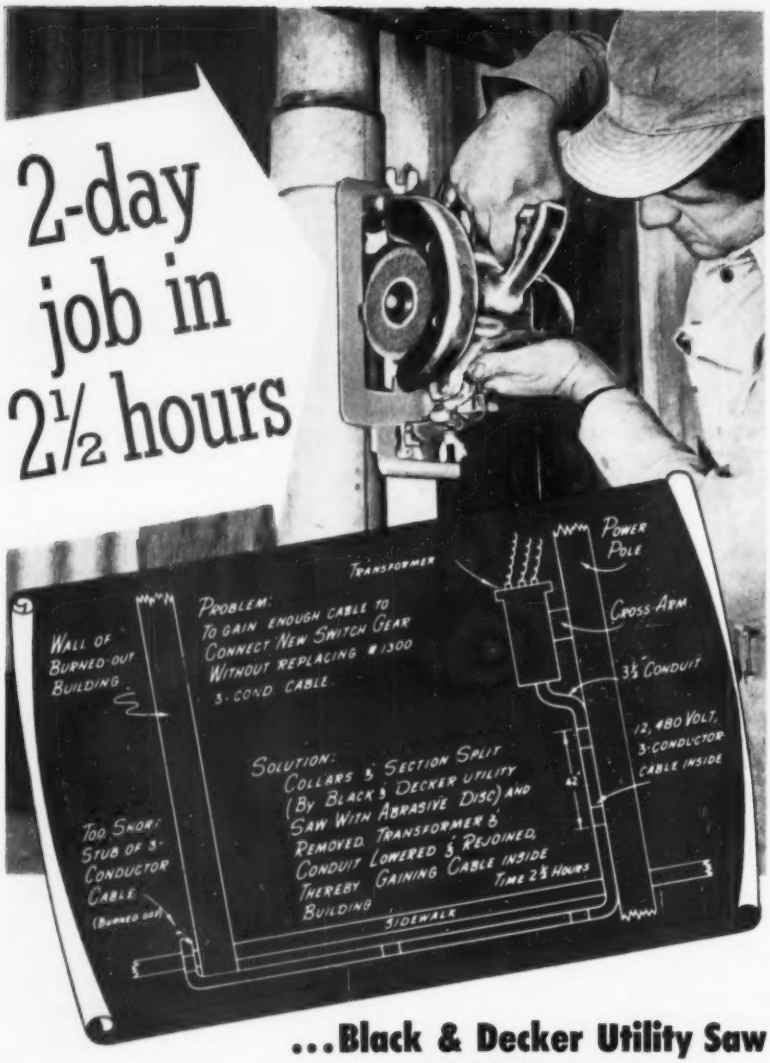
READY TO ROLL on any electrical construction job is this portable temporary distribution panel. Enclosing metal cabinet has back-of-board circuit connection features, flanged double doors, side door access for cables, padlock facilities and large casters for easy mobility.

Arc Welding Connections For Small Aluminum Wires

CONSTRUCTION

Small sizes of aluminum wire have numerous uses in the electrical field, such as windings for small motors and transformers, household circuits or secondary systems in industrial plants. However, the problem of making satisfactory connections has limited these applications, since crimping or soldering methods have not proved completely reliable. Now, however, engineers of the Aluminum Company of America recommend making connections by an arc welding process and—having tested this method extensively in the wiring of the new Alcoa headquarters skyscraper in Pittsburgh—they claim that the procedure is rapid, the joints have good resistance to corrosion and conductivity is excellent.

Wire sizes up to about No. 8 are joined satisfactorily with a direct current arc, with eight standard 6-volt storage batteries connected in series and tapped to provide voltage levels of either 24 or 48 volts for the purpose. No surface preparation is required in


2-day job in 2½ hours
Transformer
Power Pole
Cross-Arm
3½" Conduit
12, 480 Volt, 3-Conductor Cable Inside
Problem:
To gain enough cable to connect new switch gear without replacing #1300 3-cond. cable.
Wall of Burned-out Building
Too Short Stub of 3-Conductor Cable
(Burned out)
Solution:
Collars & Section Split (By Black & Decker Utility Disc) and Saw With Abrasive Disc &
Removed Transformer &
Conduit Lowered & Rejoined,
Thereby Gaining Cable Inside Building
Time 2½ Hours
42"
Sidewalk

...Black & Decker Utility Saw saves $1,300 plus

THE problem . . . the solution . . . they're shown above. But it took a Black & Decker Saw to *do the job.*

There were two ways that the Superior Electric Co., Dallas, Texas could do this job on a large, completely burned-out industrial site.

One was to melt 60 lbs. of insulation wax in the transformer to get at the connections, remove the old cable, and thread the conduit with $1,300 worth of new cable . . . an expensive, two day job.

The other . . . the faster, less costly way utilized a 6" Heavy-Duty Deluxe Utility Saw. It simply involved cutting the conduit, collars and sidewall, lowering the transformer on its outdoor pole, and pulling the old cable (still good as new) into the building for splicing.

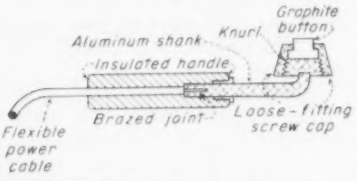
Sawing was done with a 6" abrasive disc in two successive cuts on opposite sides of the conduit. First cut was half way through, then to within 1/16" of inside conduit surface. Conduit was then separated by knocking out thin wall with a screw driver. The smooth cutting of the B&D Saw turned out a perfect job. The cable was unmarked, not the least bit damaged by overheating. Result: $1,300 saved . . . 2½ hours to do a two day job.

What's your sawing problem? Chances are there's a Black & Decker Utility Saw that'll do the job. 6" to 9" blade diameter models available. From $56.50.

Visit your B&D outlet for a demonstration. For free descriptive B&D Saw Catalog write to: THE BLACK & DECKER MFG. Co., 617 Pennsylvania Ave., Towson 4, Md.

Black & Decker
UTILITY
PORTABLE ELECTRIC TOOLS

INSULATION of aluminum wires is stripped back, wires are twisted into a compact pigtail, the joint is grasped near the base with electrode pliers and a weld is made by striking an arc between the twisted wires and the carbon electrode.



CROSS SECTION through right-angle dc welding torch indicates arrangement of holding graphite electrode in place, brazing aluminum shank to flexible power cable, and securing the insulated handle in place.

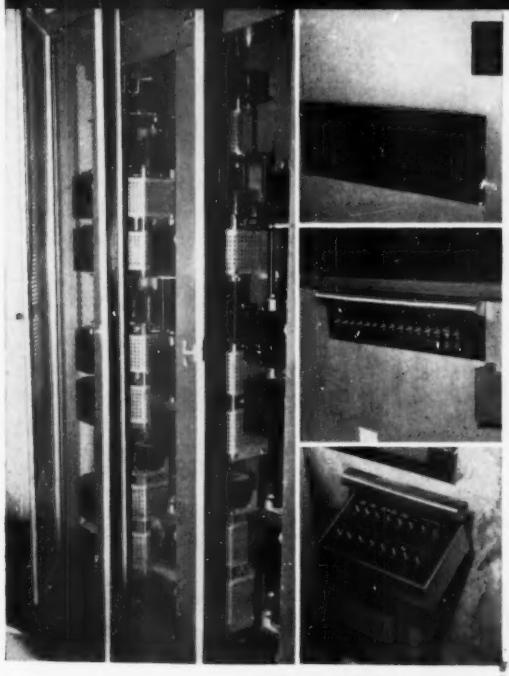
making the wire joints other than the removal of the insulation so that a good ground connection can be made, and the weld is made simply by striking an arc between the wire and the carbon electrode. Neither a flux nor any special protective atmosphere is required.

During the development period, trials were conducted at 6, 12 and 18 volts with no success, although good arcing occurred at 24 volts and a satisfactory weld bead formed. As the amount of metal to be welded increases however, higher voltages are required, thereby dictating the 48-volt tapping arrangement. Little research has been devoted to the selection of a special electrode, since graphite has proven quite satisfactory, and both tungsten and copper have given good results.

The electrode holder has a flexible power cable brazed directly to an aluminum shank, and a graphite button is held in contact with this shank by an aluminum screw cap. A handle of insulating material covers the brazed joint and also screws onto the shank. This type of construction is light in weight, sturdy and economical. It also may be used for any wire size and, when necessary, the carbon electrode may easily be replaced.

Experience gained in experimenta-

powerstat light dimming equipment helps create a setting of reverence and devotion at SAINT SOPHIA CATHEDRAL, California



Architects: A. R. Walker
Gus Kalionzes

Electrical Engineer: H. F. Johnson
Electrical Contractors:
Pacific Electrical & Mechanical Co.

CONTROLLED LIGHT brings out the full beauty and richness of the traditional Byzantine interiors in the magnificent new Greek Orthodox Cathedral of Saint Sophia in Los Angeles. The Superior Electric Company is privileged that POWERSTAT light dimming equipment was selected to underscore the moving, centuries-old orthodox services.

The ultimate in light dimming equipment, the LUXTROL System, is employed to great advantage. Numerous miniature dimmer control panels are conveniently located in the cathedral with the motor-driven POWERSTAT Dimmers installed in an out-of-the-way space. Each selector station offers big switchboard operation in a compact, console-type control board.

Portion of the central POWERSTAT dimmer installation and several of the selector stations.

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STABILINE AUTOMATIC VOLTAGE REGULATORS
5-WAY BINDING POSTS

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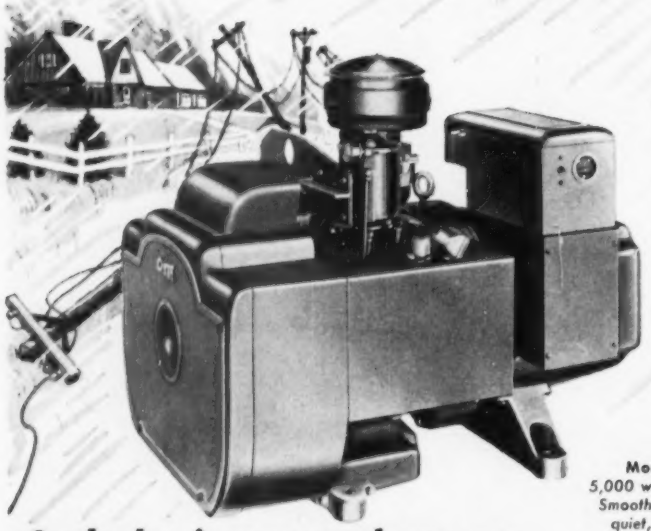


Model 5CW
5,000 watts A.C.
Smooth-running,
quiet, compact

Include, in your plans, an ONAN *Emergency* Electric Plant

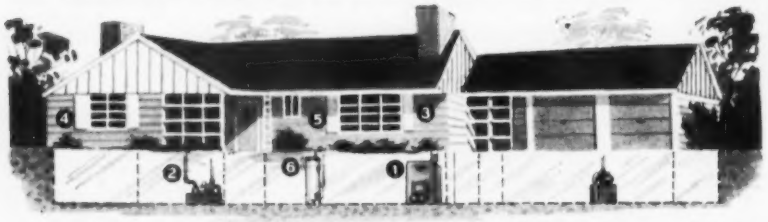
The homes you help build become unlivable and even unsafe when storms, floods or other disasters interrupt electric power.

Suburban homes are especially vulnerable because of their complete dependence upon electricity. When power interruptions occur, these homes are without heat, water, refrigeration and lights. Freezeups and food spoilage can cause severe losses; fire hazards are increased.

A low-cost Onan Emergency Electric Plant is insurance against power interruptions. When they do occur, the Onan plant supplies regular 115-volt A.C. electricity for all essential uses as long as the emergency exists. Automatic controls start the Onan unit when power fails and stop it when power is restored, protecting the home at night or when the family is away.

Very little space is required for installation in basement or garage. Hook-up to the wiring system is simple. Write today for information on dealership and folder describing Onan Standby Electric Plants . . . gasoline-driven, 1,000 to 50,000 watts A.C.

PROVIDES ELECTRIC POWER FOR THESE ESSENTIAL USES—



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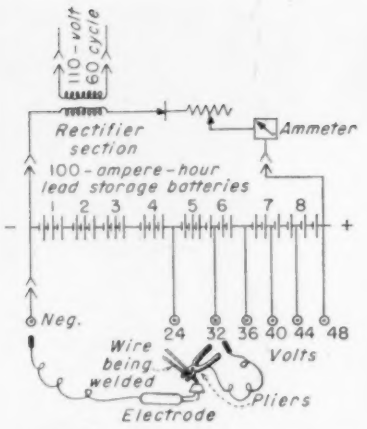


SCHEMATIC DIAGRAM showing arrangement of 6-volt batteries in series, connection clips, electrode, pliers and aluminum wires to be welded in a pigtail splice.

tion showed that a certain amount of mechanical configuration is necessary to obtain the best welds, with the two or more wires parallel to one another and in intimate contact. Also, since little physical strength is possessed by the aluminum weld bead, additional mechanical strength is desirable. These conditions may be satisfied by twisting the wires to form a pigtail, wrapping an additional wire around the joint, or crimping a sleeve over the wires.

Electrical resistance of the welded joint is equivalent to other methods of joining wires, the electrical connection is positive and, since no flux or dissimilar metals are involved, the corrosion resistance is high.

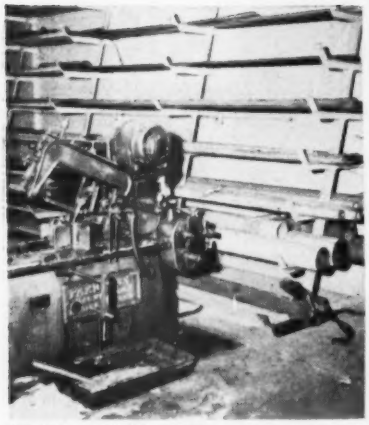
In making a welded pigtail joint, the insulation covering the wires is stripped back, about six twists are put in the wires with a pair of pliers, the joint is grasped near the top with electrode pliers, and the weld is made by striking an arc between the wires and the carbon electrode.

Conclusions indicate that welded connections can be made more readily and rapidly than soldered joints, better corrosion resistance can be expected, poor connections may be spotted easily by visual inspection, storage batteries provide a power source on all construction jobs, equipment can be placed in operation instantly and welded joints require no subsequent cleaning.

Practical Shop Layout Cuts Material Handling

PRODUCTION

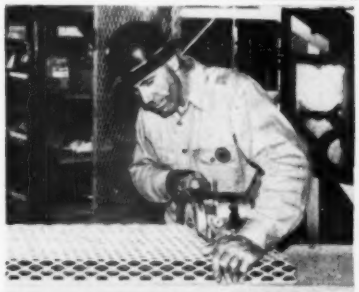
Surveys in many industrial plants have shown that as much as 60% of the labor required to produce a product is devoted solely to the necessary al-



POWER HACK SAW adjacently positioned to sturdy storage racks where conduit, channels and angles are kept, saves time, space and effort in the cut-ream-thread sequence so-frequently practiced by shops and contractors.

though non-productive chore of moving, shifting, lifting, storing or shipping of materials used for the various processes. In shops and contractor warehouses, this non-productive percentage is less, although it still is an important factor contributing to the overhead and, therefore, the profit.

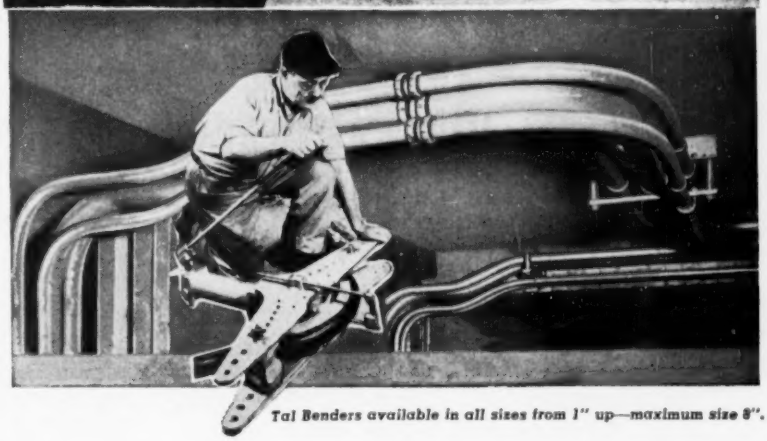
With this fact in mind, considerable thought went into the layout of the offices, shops and storage areas of the Pacific Electric Motor Company in Oakland, California, and material is now received, stored, processed and shipped out in a straight-line procedure with minimum handling involved. For example, conduit, angles and channels are stored along one of the brick walls on sturdy inclined racks formed from angles welded as shown in the accompanying photograph. When exact lengths are required, they are cut on an adjacently-located power hack saw, then reamed and threaded on equally-handy machines. Steps between bins and these machines are few in number, and lifting and shifting can be performed quickly by the machine operators.



POWER HAND SAW with metal-cutting blade is considerable time saver on electrical construction project. Here, mechanic slices section off metal cable trough to fit job requirements on a California generating plant installation.

TAL PORTABLE BENDERS

BEND THINWALL or RIGID CONDUIT FASTER



Tal Benders available in all sizes from 1" up—maximum size 8".

You can earn bigger profits by reducing up to 80% the number of elbows and couplings otherwise needed. Save on cutting, threading and installing. This is possible with a Tal, because Tal Portable Benders make any degree bend in *one setting without shifting the conduit* . . . and do the job faster!

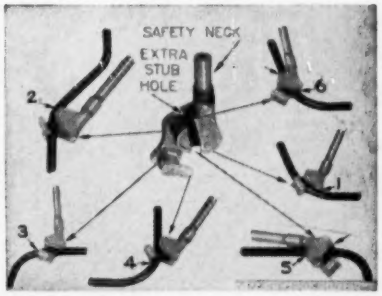
No guesswork for offsets, long sweeps or any other bends. No experience necessary to make accurate, wrinkle-free bends quickly, right on the job. *No spoilage.* Bend indicator assures identical repeat bends without measuring.

Actual bending time of a 90° bend in 3" conduit with a motorized Tal Bender—1 minute, 51 seconds. Other sizes in proportion. Assembly time of a Tal Bender (2 parts only)—less than 1 minute.

Learn today how you can earn more money and handle more jobs with a Tal Portable Bender.

TAL 6-WAY HICKEY FOR RIGID CONDUIT

Exclusive design of the six non-slip bending jaws assures perfect elbows, offsets, loops, saddles, stubs and sets in close quarters or on open slab work. No effort, no kinks. The bending jaw grooves of this "Safety-First Hickey" are slip-proof, and long safety neck prevents it from breaking at the threads. Has extra stub hole for bending conduit protruding from concrete. *Guaranteed for life against breakage.*



Nos.	Size	Weight	Package Price of Ten	Unit Price
50	½"	3½ lbs.	$3.10 ea.	$3.70 ea.
75	¾"	5 lbs.	3.90 ea.	4.65 ea.
			Package Price of Three	
100	1"	8½ lbs.	6.65 ea.	7.95 ea.

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For rigid conduit up to 5 inch and small Combination Production Benders for Rigid and Thinwall Conduit, for ½" and ¾".

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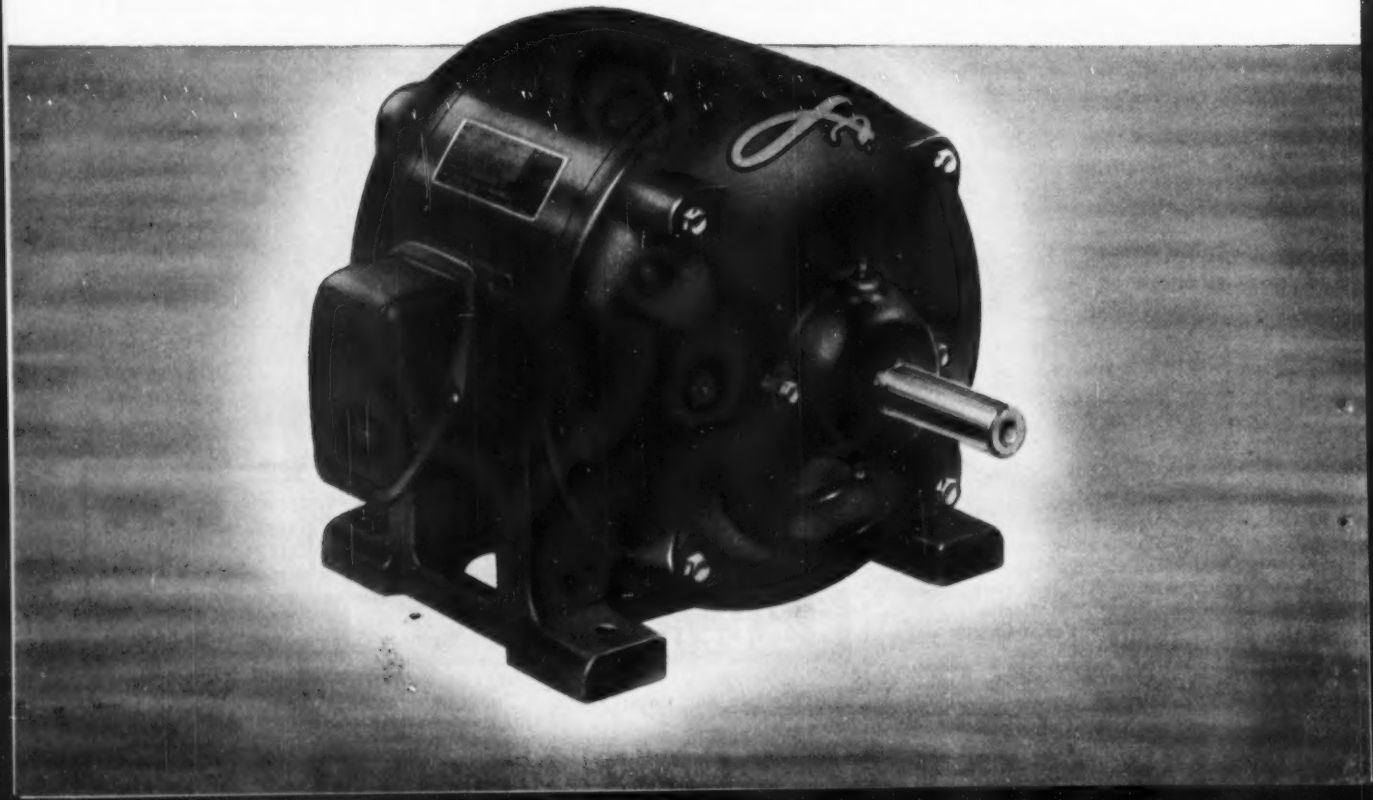
THE LOUIS ALLIS CO., Milwaukee 7, Wisconsin



Motor Shops

ADJUSTABLE ARMATURE STAND was shop-made to suit a variety of armature repair operations at Penn Electric Motor Co., Philadelphia; consists of U-shaped cradle assembly mounted in knuckle in pipe rack along bench.

Bench Holder For Armatures

A special armature holder that is completely adjustable for holding and positioning armatures in a wide range of sizes has been developed in the shop of the Penn Electric Motor Company, Philadelphia, Pa. This assembly has added speed and ease to many operations in the repair and testing of armatures.

As shown in the photo, this armature stand is simply constructed. The main support for the stand is a rack constructed of 1¼-inch pipe and mounted along the front edge of the work bench. At each man's position along the rack, there is an open knuckle in the horizontal run of the pipe. Each knuckle is fitted with a section of pipe which can be raised or lowered; and a U-shaped assembly of flat steel is mounted on each short section of pipe. The U-shaped assembly has a half-round cradle at the upright ends of the U and is adjustable in width to accommodate armatures of varying length. The two pieces of steel which make up the U are locked in position by a bolt in the section of pipe which fits into the knuckle. The employee can rotate the armature in the holder and can turn it to any position to suit the particular work he may be doing on it. The assembly can also be raised or lowered in the knuckle.

"Since we have installed this armature holder," says Joseph Previty, "our employees have found it extremely simple to work on armatures. It is a time and effort saver, enabling them to get their work out more quickly and efficiently."

Visual Stock Parts Facilitate Ordering

Selection of small motor parts and accessories is both positive and fast in the Central Armature Works of Washington, D. C., for each part is mounted on a display board behind the service counter and the serviceman or customer can quickly spot his wants, whether or not he knows the technical name, the manufacturer or catalog number. Beneath each part is a full description, listing the number of the bin in which the supply is stored, the brand name, correct name, price and inventory number.

This method of identification takes the guesswork out of ordering. It makes it easy for customers to pick out what they want. It also serves as a visual reminder, frequently suggesting to the customer an item which he might otherwise have overlooked. Return and exchange of wrong parts has been completely eliminated, and stock clerks quickly become familiar with the location and price of all items carried by the firm.

De-Reeler Combines Facilities For Alignment And Tension

A de-reeler for rectangular wire has been constructed in the electric motor repair shop of George Lockwood, Trenton, N. J. The unit, capable of holding four wire spools of any size, has a tension arrangement to prevent spools from unreeling too freely. The de-reeler may be readily shifted, permitting exact alignment with the winding machine.

It is constructed on two 5-foot sections of 8-inch H-column, with welded angles across the top for strengthening purposes. Grooves in the cement floor permit easy movement, while bolts through the column bases insure positive positioning and anchoring.

Bearings are mounted on each face

WITH PARTS IN VIEW, selection of parts is accurate and quick. Tags beneath displays list the price, bin location and trade name, thereby facilitating accurate identification and billing.

ADV.

IRVINGTON
INSULATING VARNISH DIGEST

Internal Curing Type Of Varnish Results in Complete Drying and Integrated Windings

Conductors are held in a compact homogeneous mass, free from wet, tacky interiors when impregnated with any of Irvington's internal curing varnishes.

These varnishes assure deep penetration and thorough curing, while at the same time permitting the use of fast, money-saving baking schedules. Range of types available permits selection to meet specific requirements such as: high oil and heat resistance; complete oilproofness; exceptional mechanical strength; long life at high temperatures; extreme resistance to chemical attack.

Motor repair shops dip stators and armatures in Irvington's internal curing varnishes for deep penetration, fast curing throughout and strong conductor bonding

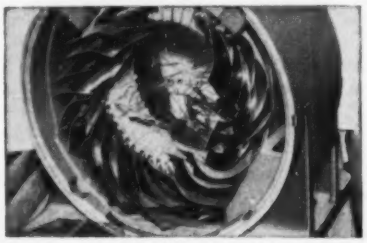
Special Binder Used in Slot Insulation

A newly developed binder for bonding a fibre backing to flexible varnished insulation makes it possible for Irvington to produce a slot insulation with mechanical strength needed to withstand forming to fit any type of motor slot. Used in Irvington's IRV-O-SLOT cell insulation, this binder has the "give" necessary to prevent rupture of the varnish film during the forming operation. The binder does not harden with age nor ooze out under the effects of heat. Both shelf life and service life are greatly increased.

Motor Repair Shops Face Growing Demand For Rewinds with Class "H" Insulation

Design Trend to Use of High-Temperature Materials Points Way to Need for Same Insulation in Repairs

The reduction in frame sizes and the increased overload capacity made possible by motors designed for the use of Class "H" insulation have led to the increased use of materials of this type by electrical manufacturers. More and more of these motors, in which the insulation is capable of withstanding continuous operation at 175° C., are now in use throughout industry. While an outstanding characteristic of these motors is their ability to withstand high ambient temperatures or heavy overloads, it is natural that their windings may fail under conditions of severe abuse. Motor repair shops and industrial maintenance departments will therefore be faced with an increasing need to rewind these motors with the same Class "H" insulations with which they were originally wound.

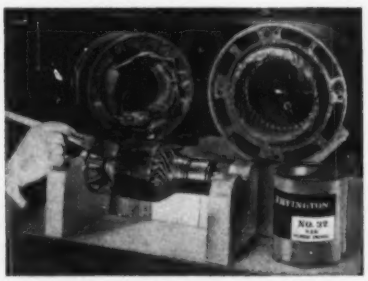


For long life at 175° C., phase coils and slot cells of this motor are insulated with Irvington Class "H" Silicone Varnished Fiberglas

Oilproof Finish Coats Improve Rewind Jobs

For extra protection of motor windings against the harmful effects of oil, grease, moisture and chemicals, a finishing coat of quick-drying enamel can be easily applied by a dip, spray or brush-on operation to windings already impregnated with Irvington Insulating Varnishes.

Irvington Red Enamel No. 32 is commonly used where fast drying time, consistent with good protection, is desired; No. 30 Red is preferred when service conditions are exceptionally severe.



Irvington Red Enamels are easily brushed on, give added protection against oil, grease, dust

Types of Class "H" Insulation

Class "H" insulation consists of inorganic materials, such as Fiberglas* or asbestos, treated with silicones or other high-temperature materials. The Irvington Class "H" insulations most commonly used in motor manufacture, and hence most commonly required in Class "H" rewinds, include:

Silicone Varnished Fiberglas, Silicone Coated Asbestos, Silicone Saturated Asbestos, Silicone Rubber Coated Fiberglas, Teflon** Coated Fiberglas, Silastic ®*** Tape, Silicone Rubber Coated Fiberglas Tubing, Silicone Coated Novabestos****.

All of these Irvington Class "H" insulating materials retain their excellent physical, chemical and dielectric properties under continuous operation at elevated temperatures.

In addition, the wide range of Irvington materials permits the rewind of Class "H" motors so that they will meet other severe operating requirements. For example, Silicone Rubber Coated Fiberglas and Silastic® Tape remain flexible at temperatures as low as —70° F. and, Silicone Varnished Fiberglas resists moisture.

Corrosive Atmospheres

For applications where corrosive atmospheres are involved, Teflon Coated Fiberglas is commonly used. This insulation possesses an exceptional degree of chemical inertness, is low in water absorption, unaffected by outdoor weathering. Send for your free copy of Irvington's Class "H" Insulation booklet.

* ®Owens Corning Fiberglas Corp., ** ®du Pont de Nemours, *** ®Dow Corning Corporation, **** ®Raybestos-Manhattan, Inc.

For further information, write the Sales Manager, Varnish Dept., Irvington Varnish & Insulator Co., 18 Argyle Terrace, Irvington, N. J.

WIRE REEL RACK can be moved along the floor grooves. Reels are lifted into position by means of chain and sling.

TENSION IS ADJUSTED by forcing springs against clutch plates, spinning the back-up plate until the desired pressure is obtained.

LOCKNUTS hold wire reels in contact with back-up plates fitted with protruding pins which engage holes drilled in spools.

of both columns, supported by a 1¼-inch arbor which passes through the column webs. On one side of the web, circular 12-inch steel plates are positioned to back up the wire spools. Six 1-inch pins, welded to these circular plates, engage holes drilled in the spool frame and prevent slippage.

On the opposite sides of the columns, other similar plates are backed by clutch discs, heavy coiled springs, and tightening nuts. Tension is adjusted by spinning the tightening nuts, and nuts are fitted with wing handles to facilitate manual adjustment and minimize the possibility of misplacing the nuts.

Special Data Card Saves Time

Whenever armatures come to Albertson & Son, Philadelphia, for rewinding, they check their data files to see if they have a complete data card on the armature that they are going to work on.

Because of the large number of different armatures that this firm receives, it is possible that they do not have a data card on every armature which comes in for repair. If this is the case, they prepare a data card on the armature before it is torn down.

"Our data cards gives us a complete picture of the armature," says Al Albertson, "and before armatures are sent to the dismantling department, everything concerning that armature is recorded on a special data card that we have worked up."

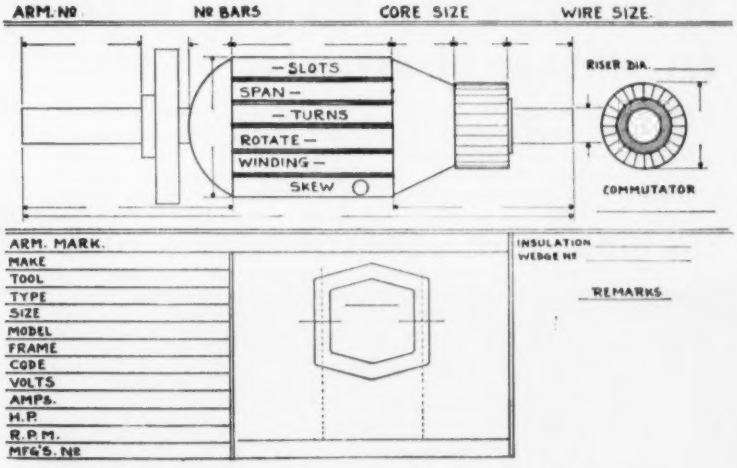
"This card remains in our permanent file and can always be referred to by employees when working on that armature. The card itself shows how complete the information is when taken from the armature before dismantling. These cards have saved us many man hours when certain operations have to be done on armatures, as all guess work is eliminated through the use of these cards."

Causes and Cures for Overheated Bearings

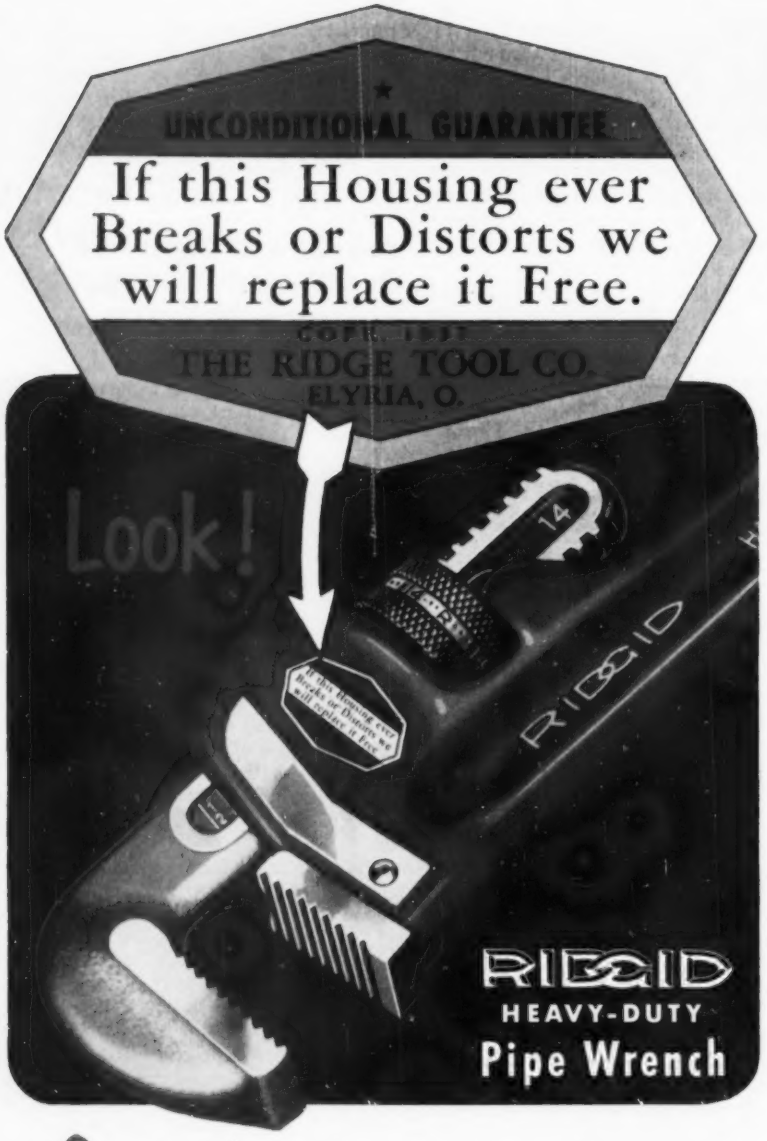
When a bearing overheats, efficiency starts to slip and the possibility of a major maintenance job is a definite threat unless the *reason* for the overheating is quickly located and corrected. According to the Anti-Friction Bearing Distributors Association, causes may vary all over the map, ranging from low oil level and warped housings to improper alignment of shafts or an unbalanced loading situation. However, these causes may be quickly determined by following a logical sequence of inspection. Then, with the source of trouble positively identified, steps can be taken to promptly correct the fault.

For example, overheating may be caused by low oil level, loss of lubricant through the seal, or insufficient grease in the housing. This may be corrected by keeping the oil level at the center of the lowest ball or roller in the bearing. If grease is being used, the lower half of the pillow block should be kept filled.

Another reason for overheating might be a housing packed with grease, or an oil level that is too high, causing excessive churning of the lubricant, high operating temperatures and oil overflow. This condition can be corrected by purging the bearing until only the lower half of the housing is filled with grease, or reducing the level



SPECIAL DATA CARD is used by Albertson & Son, Philadelphia, to record all information on every armature rewind job before it is torn down.



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Work-Saver Pipe Tools

FIG. 1—High oil level results in wasted lubricants, high-temperatures and excessive churning.

of oil until it covers only the bottom half of the lowest ball (Fig. 1).

Bearings might have been selected improperly, with inadequate internal clearance for conditions where external heat is conducted through the shaft, thereby expanding the inner ring excessively. To correct this, replacement bearings should have the same markings as the original bearings.

Other sources of trouble are housing bores that are out of round, warped housing, excessive distortion of housings, or undersized housing bores. To relieve pinching of bearings, housing bores should be checked and scraped. Inspection should also verify that pedestal surfaces are flat and shims cover the entire area of pillow block bases.

Sometimes overheating is due to rotating seals rubbing against stationary parts. Inspection will show whether running clearance of the rotat-

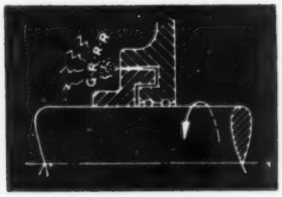

FIG. 2—Rotating seals, rubbing against stationary parts, can be cleared by correcting the alignment.

ing seal is sufficient, if not, alignment should be corrected (Fig. 2).

Still another reason for overheating is the fact that two "held" bearings are on one shaft, probably due to excessive shaft expansion. This may be corrected by backing off the covers in one of the housings, using shim to obtain ade-

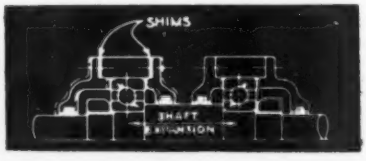

FIG. 3—Two "held" bearings on a single shaft calls for shimming to obtain adequate clearance of outer ring.

quate clearance of outer ring, permitting free axial bearing motion (Fig. 3).

If the cause is found to be an unbalanced load or a housing bore that is too large, the machine should be rebalanced, or the housing should be re-

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Totally Enclosed Fan Cooled Type **keeps out dust, moisture, oil and abrasive grit.** ***Open Drip-Proof Type*** **provides adequate protection from falling liquids.** ***Windings*** **are insulated with high-quality materials and finally dipped in thermo-setting varnish and baked to give mechanical strength and high resistance to the entry of moisture and oil.** ***Bearings*** **of standard sizes are fitted and are of ample size to give long life under all drive conditions.** ***Shaft*** **is designed to withstand overloads and shock loads.**

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placed with one having proper bore.

Incorrect linear angular alignment of two or more coupled shafts with two or more bearings is another reason that could result in excessive heating. Correct alignment may be obtained by shimming the pillow blocks, and the inspector should make sure that shafts are coupled in a straight line, espe-

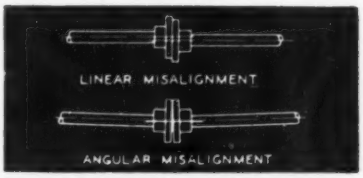


FIG. 4—Misalignment of shafts, either linear or angular, can be corrected by shimming the pillow blocks.

cially when three or more bearings operate on one shaft (Fig. 4).

The cause of overheating might also be found in the incorrect mounting of constant-level cups (too high or too low), or the cup could be located on the wrong side of the bearing in relation to the direction of rotation. The level of the cup should be such that the resulting level of the oil is at the center

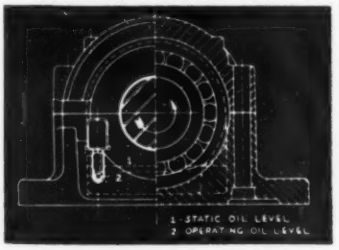


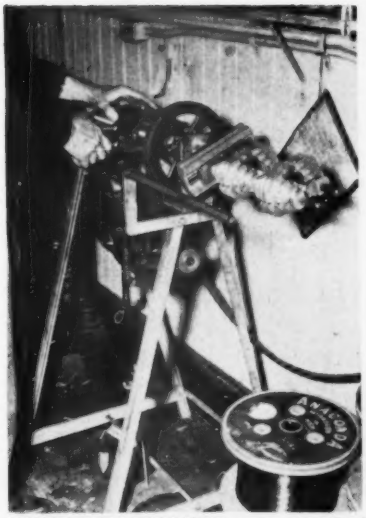
FIG. 5—Constant oil level cup should be located with direction of bearing rotation.

of the lowest ball or roller when operating.

A final reason for overheating might be due to the "pounding out" of the housing bore due to soft metal. This would result in an enlarged bore, causing spinning of the outer ring in the housing. In this case the housing should be rebored and a steel bushing pressed into the bore. The bore of the bushing should then be machined to correct size. In cases where the loads are not excessive, a tighter fit in the housing without the use of a steel bushing may correct the trouble.

Coil Winding Machine Has Automatic Cut-Off

Coil winders in the shop of the Central Armature Works, Inc., of Washington, D. C., are aided greatly in obtaining the exact number of turns for each loop, through the use of an automatic counter and cut-off.



HANDLE OF COUNTER can be shifted along the counter bar and secured at mark indicating desired number of turns to be placed on a coil. As the machine revolves, a metal finger slides along a continuous worm until it strikes the counter handle, at which point an automatic cut-off switch takes the machine out of operation.

While an automatic counter is nothing new, it generally has to be watched fairly constantly by the operator so that he can stop his machine manually when the correct number of turns has been reached. The automatic feature relieves the operator of both of these duties, for the machine is stopped automatically by a limit switch when the correct number of turns have been wound on the form.

The counter and cut-off device operate on the principle of a continuous threaded worm, with a metal finger sliding sideways as the coil machine revolves. Above this threaded worm is a bar, bearing marks to indicate the number of threads and, therefore, turns that the machine has registered. A split-nut handle grip can be moved along this bar, and secured at any desired point. Therefore, when the machine turns, the metal finger slides along the bar, pushed sideways by the threads of the worm, until the finger comes in contact with the previously-positioned handle grip. When this occurs, an automatic shut-off switch stops the machine and the coil contains the number of turns previously selected.

It is apparent, therefore, that the handle grip needs only be positioned at the mark indicating the required number of wire turns for the coil being wound. The operation becomes automatic from that point on.

This makes the job of winding less tedious, does not require the constant attendance of an operator and results in coils having an exact number of turns.

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Amplex Colorbeams come in a choice of 14 striking colors and a full range of sizes and wattages. The color is an integral part of the glass . . . will never fade, chip or crack. The sealed-in reflector linings are pure silver and provide maximum light intensity. And Colorbeams have a rated average life of 2000 hours!

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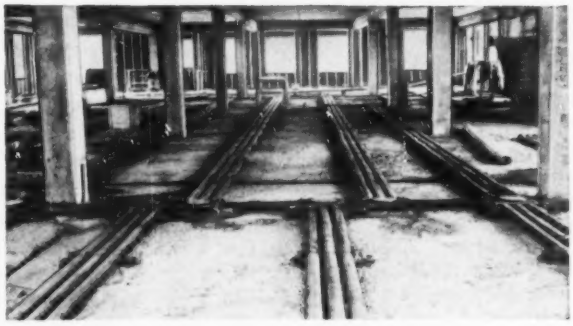
Specify G-E Fiberduct in your wiring plans for commercial and industrial buildings, to keep wiring out of the way, and to provide electrical versatility and expansibility—at a price your client can afford.



THE FIBERDUCT GRID under the floors of the Improved Risk Mutuals building provides outlets wherever they're needed, and makes electrical expansion easy.

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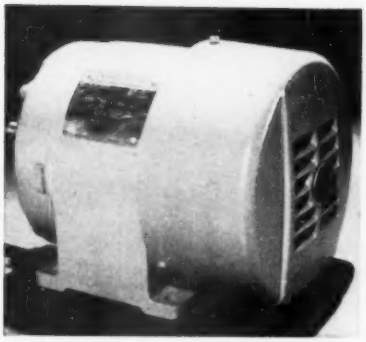
Product News



Motors (1)

A new line of polyphase ac motors, called Tri-Clad "55". Built to latest standard NEMA frame dimensions, they feature entirely new and advanced concepts of motor design. With an average size reduction of 50% by volume and averaging 22% less weight per hp, the "55" retains rigid cast-iron construction and incorporates a new insulation system, bearing assembly and ventilation plan. A new polyester film is used to insulate the phases and slot tubes in the stator. The new bearing assembly is more tightly sealed and is lubricated by a grease. A double-end ventilation system uniformly cools the motor by drawing air in from beneath both endshields, through baffled air passages, and out louvers on sides of the frame.

A major part of the new motor design involves noise levels. The noise level of the new 10 hp motor tests as low as the former 2 hp model. The totally-enclosed fan-cooled motor also has been redesigned. Besides the longer-life lubricating grease, other improved maintenance features include permanently-numbered, non-wicking connection leads, a larger diagonally-split conduit box, knock-off lugs on end shields, and location of combination nameplate connection diagram directly over box.

After the first of the year, the new motors will be available in the 182 and 184 frame sizes (1, 1½, and 2 hp at 1800 rpm) in horizontal drip-proof and totally-enclosed fan-cooled models, and a complete line of gear-motors. Larger frame sizes will become available at regular intervals. Other types planned for production during 1954 include vertical, single-phase, wound rotor, explosion-proof, multi-speed, face-mounted, and flange-mounted models.

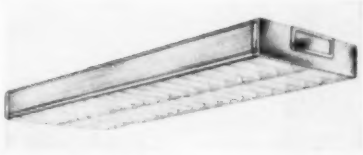
General Electric Company, Schenectady 5, N. Y.

Switch (2)

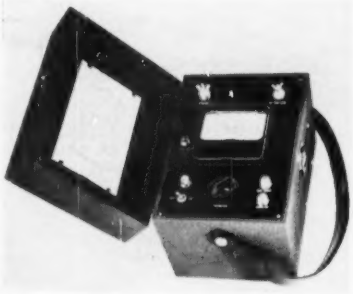
A new light switch called "Feller Feather Touch Switch". It features an easy method of wiring and connection. It offers a flat and secure "contact" plate. To connect switch, loosen screw and contact plate rises. Slip the wire's end under the plate, tighten screw, the plate comes down in a flat, positive contact with wire. It will glide from On to Off and back at the touch of a knuckle, an elbow. Another feature is silent operation. Plate and switch are made from Bakelite styrene plastic in an ivory finish. It contains pure silver contacts and operates on 15 amps, 120 volts. Tungsten rated. It has Underwriters' Laboratories approval.

H. J. Theiler Corporation, 22 Ashmont Ave., Whitinsville, Mass.

(3)



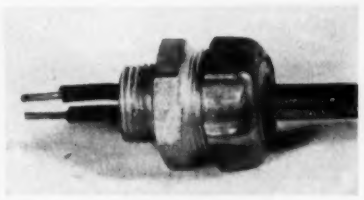
FLUORESCENT fixtures, the "Star-Liner" series, features side panels of Corning Alba-Lite glass framed by rounded metal trim rails. Available in two- and four-lamp 4-foot models for slimline, standard fluorescent or rapid start lamps; 8-foot units for 96-in. slimline lamps. Bulletin L-134 available. Manufactured by Garcy Lighting, 1750 N. Ashland Ave., Chicago 22, Ill.



Instrument (4)

New high voltage portable tester, Model 422 Hypot Junior. It features visual indication of electrical leakage and breakdown, continuously variable voltage output from 0-10,000 volts, and a kilovolt meter connected directly across high voltage output for indication to plus or minus 3% of full scale. Input is 115 volts 60 cycle ac. Instrument is housed in a steel case 11½-in. by 8½-in. by 10-in. with a removable hinged cover. Bulletin 4-1 available.

Associated Research, Inc., 3758 W. Belmont Ave., Chicago 18, Ill.



Connector (5)

A standard connector tailor-made for mineral-insulated cable, the self-contained wiring system. Key parts of watertight box fitting are a neoprene gasket and a washer-type grounding ring. Gasket acts as a moisture-proof seal and permits standardization on three connector sizes to fit M.I. cable diameters from .309 to .730. Grounding ring insures a grounding path around gasket from raceway to fitting's metallic body. Principal function of connector is to provide a watertight termination for M.I. cable. This is accomplished at switch or junction box by the fitting's tapered hub threads, while gasket keeps out moisture where connector and cable are joined.

The Thomas & Betts Co., Inc., 36 Butler St., Elizabeth 1, N. J.

Lens (6)

Strato-Ray lenses were designed for use with Pry-Lite recessed fixtures in commercial buildings and institutions. A number of prisms at outer edges of lens "bend" light rays to illuminate ceiling, while oval shaped center deflects light down. Six Pry-Lite models are available with the Strato-Ray lens: (1) shallow type for horizontal lamps of 300 watts; (2) shallow type for horizontal lamps of 150 watts; (3) standard fixture with vertical lamp, 300 watts, relamps from top or bottom; (4) standard fixture with vertical lamp, 150 watts, relamps from top or bottom. All these models are prewired for use with any standard building wire. Two models, 150 watts and 300 watts, are the shallow type, made of extra heavy construction for installation in reinforced concrete structures, are not prewired.

Pryne and Co., Inc., Pomona, Calif.

MW

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

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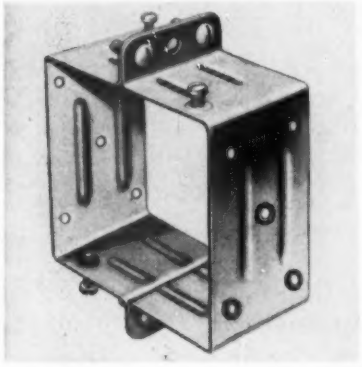
Chicago 12, Illinois

Heat Pumps (7)

New, completely-automatic heating and air conditioning system for the home, called Type HP heat pump. It provides heat in the winter, cooling and dehumidification in the summer, ventilation, circulation, and continuous cleaning of the air. The all-electric unit depends solely on air for its exchange medium. In summer it draws heat from inside air and discharges it to the outside. In winter the heat pump reverses itself. Automatic operation of the reversing cycle is made possible by the development of a simplified transfer valve for refrigerant flow control. This device when connected with a wall thermostat automatically switches unit from heating to cooling, and vice versa. Air ducts can return either under the flow at bottom of unit or through the side. Available in two sizes, a 3 hp model having a nominal heating and cooling capacity of over 30,000 Btu/hr, and a 5 hp model of over 50,000 Btu/hr.

Westinghouse Electric Corporation, Dept. T-356, 200 Readville St., Hyde Park, Boston 36, Mass.



Coupling (8)

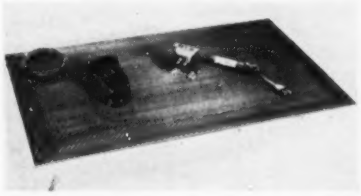
A new two-piece, squeeze-type coupling for joining lengths of Wirewa. The 4-in. by 4-in. electrical raceway sections of 1, 2 and 4 feet in length have hinged covers for accessibility—with a 1¼-in. solid ridged enclosure at each end. The 16-gauge pressed steel coupling, 2½-in. wide, is also ridged to key into individual wireway sections. It has identical forms in order to close over square wireway end sections. Developed especially for use where several wireway sections are pre-assembled, the coupling provides complete rigidity enabling the lifting of the sections into place as a unit. The coupling permits flush wall mounting of raceway through five ½-in. diameter holes pre-drilled in each side. Catalog 544-CS is available.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

Mercury Vapor Lamp (9)

A new color-corrected 400 watt JH-1 mercury vapor lamp features a special phosphor coating on the inside of outer bulb which emits red fluorescent mixing with the blue-green mercury light. This produces a white light similar in tone to incandescent light and overcomes color distortion of ordinary mercury vapor light. In performance it has a light output of 18,000 lumens, with a design life rating of 6000 hours.

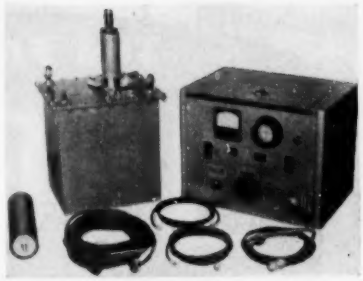
Amplex Corporation, 111 Water Street, Brooklyn 1, N. Y.



Entry Alarm (10)

A new burglary and entry alarm called Announcemat. It is a packaged unit which can be used to give an entry alarm in business and professional offices, retail stores and homes. Package consists of an 18-in. by 30-in. floormat type switch. Basic unit is a Recora Switchmat, an extended area electrical switch. A plug-in type transformer and a bell, chime or buzzer is included. The floormat switch is available in two types—"bare-floor" and "under-cover". "Undercover" type is ⅝-in. thick; can be concealed under rugs, carpets, mats, etc. "Bare-floor" type is ⅛-in. thick with tapered edges to prevent obstructing foot traffic. Floormat switches are composed of vinyl plastic and/or rubber, and are waterproof. They come equipped with 25 feet of wire for connection to transformer and alarm device. A step on any part of Switchmat will cause alarm to sound. Alarm will stop when person steps off mat.

Recora Company, 56 West 103d St., Chicago 28, Ill.



Testing Equipment (11)

Corona testing equipment for nondestructive evaluation of electrical insulation. Test sets consist of a control unit, a detector unit, and a high voltage corona-free testing transformer which incorporates means for picking up corona signals from the equipment under test. Model 1 is rated .75 kva, 20 kv continuously or 1.5 kva for intermittent duty. Also available with a larger control unit with a rating of 2 kva continuous and 5 kva intermittent duty. Model 2, rated up to 10 kva, 35 kv continuously or 20 kv intermittent duty. In operation, the equipment to be tested is connected to the high voltage terminal of the testing transformer and 60 cycle test voltage is increased until corona indication appears on the cathode ray tube in the detector unit. The rms equivalent of peak voltage is then read from the adjacent peak voltmeter. Bulletin 66-6 is available.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Radiant Heating (12)

The Sunwarm radiant heating system consists of a thermoplastic insulated cable, applied before the ceiling is plastered. A thermostat, which is the only visible evidence of the system controls the temperature of each room individually. System is installed by using special stapler provided. In addition to homes it is particularly adapted to motels and tourist courts. Sunwarm cables can be used in cellar floors, in kennels and brooders, under driveways and walks, and for soil heating in hotbeds and greenhouses. It has been endorsed by fire insurance companies, Underwriters' Laboratories and FHA and VA.

Sunwarm, Inc., Kingsport, Tenn.

THE FACTS OF LIGHT

...AND THOMPSON METAL POLE UNITS

FACT NO. 1: Modern park-site type plants are designed for appearance as well as efficiency. In keeping with this trend, THOMPSON now offers an exclusive new Metal Pole Unit that features streamlined beauty and assures peak lighting efficiency at all times.

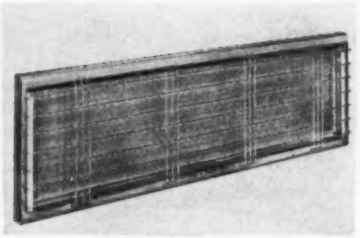
FACT NO. 2: Only THOMPSON Metal Pole Units incorporate a patented disconnecting and lowering mechanism that permits rapid . . . safe . . . efficient ground-level luminaire servicing by one man.

FACT NO. 3: THOMPSON Metal Pole Units eliminate all maintenance hazards. No ladders, scaffolding or lifts are needed for luminaire servicing . . . luminaires can be quickly lowered, relamped and cleaned, and then repositioned from the ground. Electrical dangers are eliminated because lowered fixtures are 'dead'.

FACT NO. 4: THOMPSON Metal Pole Units facilitate low-cost maintenance by saving man hours . . . reducing accidents. Pole-mounted luminaires now can be serviced at a fraction of normal time and cost.

THE THOMPSON ELECTRIC CO.

1157 POWER AVENUE • CLEVELAND 14, OHIO



Heating Panel (13)

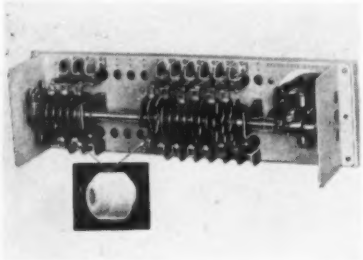
A new low boy heating panel especially designed for heating rooms with large window areas, and low sills. It utilizes a stainless steel and carbon contact for contacting the silver strip on the glass. Panels can be installed end to end to give appearance of one continuous unit. Heating unit consists of a sheet of Pyrex glass 36 inches by 8 inches and ¼ inch thick. It is rated at 750 watts, 230 volts. Outer frame is steel and all units are equipped with Kromolite plated guards.

Berko Electric Mfg. Corp., 212 Jamaica Ave., Queens Village, N. Y.

Tubing (14)

A new aluminum enamel interior coating is being applied to Nepco's Xduct rigid steel threaded conduit. The new process deposits a uniform coating of electrolytically pure zinc on the outside surfaces of the conduit by an exclusive end-suspension technique. Available in 10 ft. lengths of standard diameter sizes ranging from ½ to 6 inches. Each length has an electro-galvanized coupling on one end and thread protector on the other end. The conduit has been approved by Underwriters' Laboratories, Inc.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

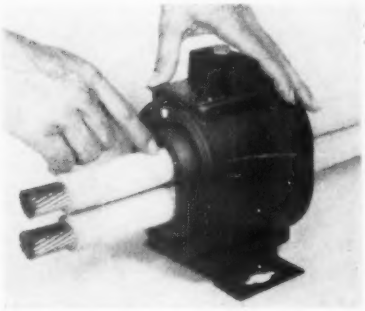


Interrupter (15)

New timer and circuit interrupter feature nylon cam rollers. Unit was originally designed to interrupt the ringing, tone, timing and signaling circuits used in telephone systems. But it also has been adapted to sequence timing in the control of industrial processes, electrical displays, automatic machinery, etc. A primary cam shaft carrying up to 22 cams and a secondary cam shaft carrying up to six cams operate the snap action switches on this machine. These breakmake switches relay the timing and impulse action. Riding on each of the polished, case-hardened

steel cams is a nylon cam roller. These rollers turn on hardened, polished and chromium plated steel shafts attached to the main spring of each switch.

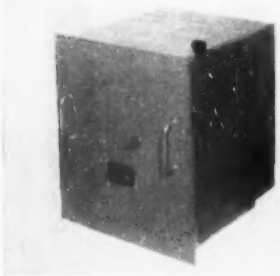
Stromberg-Carlson Company, Rochester, N. Y.



Transformer **(16)**

A "thru-type" current transformer (Type TWM) for indoor or outdoor service. It is molded in thermo-setting resin which serves as insulation, support and casing. The elliptically shaped window—1⅛-in. by 2¼-in., accommodates two 500 MCM stranded conductors with 600 volt insulation. Unit can be mounted in vertical, horizontal or inverted position and its base can be rotated 90° for greater mounting position. Transformer has conventional accuracy for light burden metering.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.



Frequency Changer **(17)**

Model 2261 frequency changer is designed to meet most requirements of accurately controlled frequency at average to higher-than-usual power level. The frequency of the output voltage is 400 plus or minus 0.1% cycles regardless of transients in input voltage and fluctuations of load. Output voltage waveform has a maximum harmonic content of 8%. It is suited as a source for supplying bus power in a laboratory or power for testing production line equipment. The output volt ampere rating is determined by the position of the manually operated "1500-2500 VA selecter switch". Unit is designed for mounting in a standard 19 inch rack. Its dimensions are 19 inches wide, 22¾ inches high, 20 inches deep.

Varo Mfg. Co., Inc., 1801 Walnut St., Garland, Texas

Install **SAFE*** All-Electric

ELECTROMODE HEAT

HARD-TO-HEAT AREAS
FACTORIES
OFFICES
ISOLATED BUILDINGS
PUMP HOUSES
METER HOUSES
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LOBBIES
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HUNDREDS OF OTHER LOCATIONS

MORE PROFIT FOR YOU

- QUICK, EASY TO INSTALL
- MINIMUM MAINTENANCE
- 100% EFFICIENT
- USER SATISFACTION

***SAFE** Only Electromode has the completely sealed-in, cast-aluminum heating element. No danger of fire, shock or burn. Built-in safety switch prevents overheating.

ECONOMICAL All current entering the unit is converted into heat. There is no heat loss en route, like there is with long steam pipe runs. This system cannot freeze. The heating element will not rust, corrode or deteriorate. For utmost economy, can be thermostatically controlled.

COMBINATION PORTABLE and SUSPENSION type models, 1500 to 7500 watts (5,122 to 25,613 btu). Adjustable louvers permit directing heat into working zone. Model AN-30A illustrated.

SUSPENSION TYPE MODELS available from 10,000 to 45,000 watts (34,150 to 153,675 btu). Adjustable louvers permit directing heat into working zone. Model 14-10 illustrated.

EXPLOSION-PROOF HEATERS for heating hazardous areas subject to explosion. In three sizes: 2000, 4000, 6000 watts (6830 to 20490 btu). Model CX-2 illustrated.

AUTOMATIC WALL-TYPE HEATER with Down-Flo principle distributes clean, healthful, fan-circulated heat at floor level. Available from 1500 to 4000 watts. Model WA illustrated.

Approved by Underwriters' Laboratories

ELECTROMODE CORPORATION
Dept. EC-113, 45 Crouch Street, Rochester 3, N. Y.

Please send us your FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating.

We are interested in ☐ Electromode Industrial Heaters ☐ Electromode Home and Office Heaters ☐ Electromode Explosion-Proof Heaters

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If . . . you want BX Staples with sharp, even points for easy starting . . .

Then ask for Titchener Rex Cable Staples. All types and sizes. In bulk, or packed in handy boxes. There's a distributor carrying Rex Staples near you.

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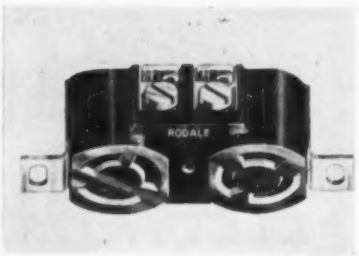
72 Clinton St. Binghamton, N.Y.
Mfrs. of Staples and Wire Parts for 65 Years



Receptacle (18)

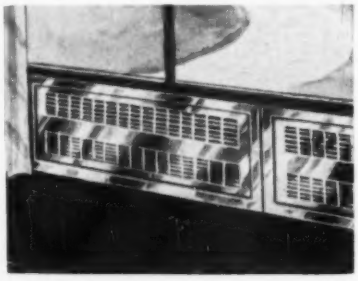
A newly-designed 3-wire duplex receptacle of the grounding type has been added to this line. 15 amp, 125 volt, it takes standard parallel or polarized parallel caps and is adaptable for back or side wiring. It features a specially-constructed break-off point on terminals for 2-circuit installations. In addition, it will accommodate new grounding type U blade plugs as well as two armored or rubber caps. Large binding head screws assure easy wiring, with a hexagonal green screw for the grounding wire. Completely interchangeable with all other makes, it fits standard duplex plates, and is recommended for use in situations where grounding of exposed metal parts of portable electrical equipment is required. Cat. No. 572 available.

Rodale Manufacturing Co., Inc., Emmaus, Pa.

Fluorescent Tube (19)

A new fluorescent tube, named "Jade-Lite", has been designed especially for industrial use and is offered in a complete range of wattages and sizes. Lamp is in the blue-green spectral range and is specifically recommended for application in factories, drafting rooms, accounting offices, machine shops, newspaper plants, laboratories, and all types of industrial-commercial areas. Each tube is dated and guaranteed for 24 months. Literature available.

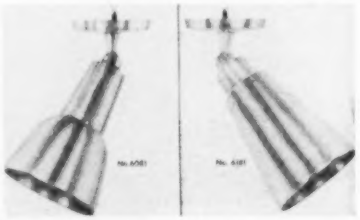
Lustra Corporation of America, 36 Washington St., Brooklyn 1, N. Y.



Electric Heating (20)

New baseboard convection electric heating, called Circle Air, features Eutectic safety device and built-in thermostat. The built-in safety device prevents heat within unit from rising above 217°. It automatically breaks the current at this temperature. It can be installed directly on floor. If grill opening is obstructed by rugs, furniture, etc., there is no danger of fire. Entire system is approved by Underwriters' Laboratories. Each unit has a built-in thermostat or wall thermostat. Units encased in grey hammertone metal cabinets are 3-in. in depth, 10-in. high, can be installed recessed or free standing. Three sizes are available in 700, 1050 and 1400 watts, 115 and 230 volts with built-in or wall thermostat.

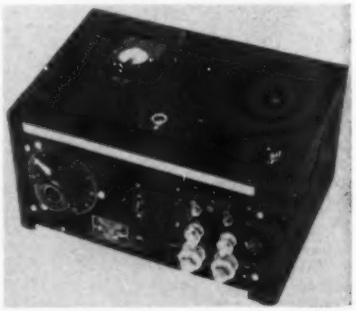
Paley Manufacturing Corp., 244 Herkimer St., Brooklyn 16, N. Y.



Lighting Units (21)

Two new shade lines of lighting units, the Capri and the Catalina, have been introduced. The Capri is a bell silhouette and the Catalina is straight line. Both groups are finished in brushed satin aluminum. There are 16 models in each line, including units for 3½-in. or 4-in. outlet box attachment as well as for wall mounting; portables; clamp-ons; screw-ins; clusters; extension pipe and curved arm units. Several units are made with Shur-Mount wall attachment and all units feature universally adjustable Swivelier spring-tension socket-angles 90° and rotates 360°. The shades accommodate up to 150 watt R-40 or PAR-38 lamps. They are made with a special ventilation cup, baffled to prevent light spill. Bulletin No. 133 is available.

Swivelier Company, Inc., 43-34 St., Brooklyn 32, N. Y.



Instrument (22)

Portable test instrument available with built-in six-range ammeter. Model No. 1005/336 includes an ammeter which covers the entire output range of Multi-Amp in six stages: 0 to 10/25/100/250/-500/1000 amperes. It is adjustable in stepless increments with fingertip control. If used to test current actuated devices can be instrumental in reducing electrical equipment and power failures, minimizing plant down-time and assuring maximum operating efficiency from electrical equipment.

Multi-Amp Corp., Harrison, N. J.

FOR RESIDENTIAL AND MULTIPLE DWELLING INSTALLATIONS

USE P&S®

SWITCHES • OUTLETS WALL PLATES

Install P&S Duplex Outlets

Designed for Easy Wiring

P & S 1560

Good

Parallel Slots, Single Grip Contacts. Narrow Ears. *Brown* 1560. *Ivory* 1560-I.

DESIGNED RIGHT

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Better

Parallel Slots, Single Grip Contacts. Plaster Ears. *Brown* 1565. *Ivory* 1565-I.

BUILT RIGHT

P & S 1570

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Parallel Slots, Double Grip Contacts, Plaster Ears — Meets Federal & REA Specs. *Brown* 1570. *Ivory* 1570-I.

PRICED RIGHT

Install P&S Switches

Designed for Easy Wiring—for Hard Usage Year after Year

Good

Porcelain Cup Type, Non-T-Rated With Narrow Ears: *Brown* S.P. 4301, 3-W 4303. *Ivory* 4301-I, 4303-I. With Plaster Ears: *Brown* S.P. 5301, 3-W 5303. *Ivory* 5301-I, 5303-I.

P & S 5301

Better

Totally Enclosed Plastic, with Plaster Ears, Non-T-Rated. *Brown* S.P. 1871, 3-W 1873. *Ivory* 1971, 1973.

P & S 1871

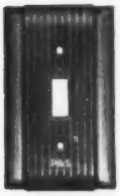
Best

Totally Enclosed Plastic, with Plaster Ears, T-Rated. Meets Fed. Spec. W-S-896. *Brown* S.P. 7301, 3-W 7303. *Ivory* 7301-I, 7303-I.

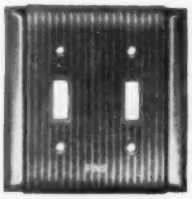
P & S 7301

Finish the Job with P&S UNILINE® WALL PLATES . . . THE MOST MODERN DESIGN ON THE MARKET TODAY

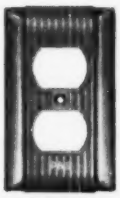
Brown	*Ivory*	
91071	92071	1-G Switch Plate
91072	92072	2-G Switch Plate
91101	92101	1-G Duplex Outlet Plate



P&S 91071



P&S 91072



P&S 91101

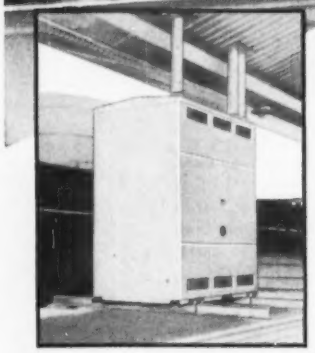
Every P&S device is a quality device — the result of experienced engineering, precision manufacturing and rigid inspection. Day and night all P&S switches are undergoing tests on custom-built testing machines. All P&S outlets are tested constantly. When you sell, specify or install P&S, you can be sure there is no secondary quality — no secondary line.

Switches and outlets illustrated are recommended for residential and multiple dwelling installations *where price is a factor*. Find out about these and hundreds of other first quality wiring devices. Write now for catalog.

Address Dept. M

PASS & SEYMOUR, INC. SYRACUSE, N. Y.

OFFICES: 71 Murray St., New York 7, N. Y. • 1229 W. Washington Blvd., Chicago 7, Ill.



SANTA FE RAILWAY — UNION PACIFIC RAILROAD — SOUTHERN PACIFIC COMPANY

Specifications for the stringent power requirements for Los Angeles Union Passenger Terminal were set up by a group of electrical engineers representing the three railroads that operate the terminal, and were met by the purchase of Marcus dry type Transformers.

The installation consisted of 12 Marcus 300 KVA, 3 Marcus 225 KVA dry type Transformers installed outdoors. All Marcus dry type Transformers are now being constructed with Hi-Heat, Hi-Dielectric Magnet Wire, insulated with DuPont's Newest miracle polyester film "Mylar," combined with Johns-Manville "Quinterra" to reach insulation levels at least 10 times present industry standards.

Increase your power performance standards with Marcus dry type Transformers.

Capacities from 1 to 3000 KVA

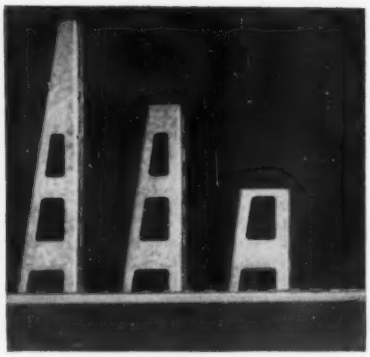
- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

"Mark of Quality"

Representatives in Principal Cities

MARCUS TRANSFORMER CO., INC.
HILLSIDE 5, NEW JERSEY

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY



Mounting Bracket (23)

A new one-piece quick-mounting bracket. These supports can be placed securely into slotted vertical channel pieces by a twist of the wrist. The new construction reduces assembly time required for the two-piece "Rakit". One-piece bracket is available in 3, 7, 13 and 19 inch lengths. Greater lengths can be obtained by use of extenders. Bulletin available.

Rakit Corporation, 711 South 50th St., Philadelphia 43, Pa.

Exhaust Fan (24)

A new ceiling type exhaust fan suitable for use in kitchen, bath, recreation room, etc. It carries a 500 cfm free air rating and is listed under re-examination service of Underwriters Laboratories Inc. The aluminum grill has a screen backing. A feature is the simplicity with which fan can be removed for cleaning. Housing comes in hammer finish. With it are two detachable supporting brackets which are adjustable for use with either plaster or wallboard construction, making it suitable for installation in new construction. The motor, grill and fan blade are one unit. To install, plug unit into receptacle in housing and secure to housing with two self-locating screws.

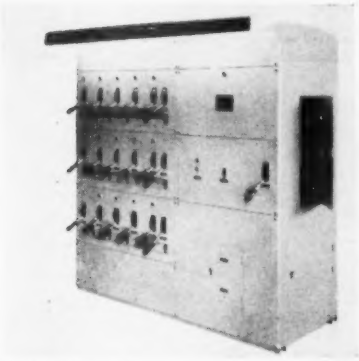
Phoenix Fan and Blower Mfg. Co., 112 South Eighth Ave., Phoenix, Ariz.

Rectifier (25)

A new plating rectifier, Model No. P6-500T, which is a 0-6 volt unit rated at 500 amperes continuously. It is capable of delivering 500 amperes continu-

ously with a 30-step voltage control and it also has a self-contained magnetic starter. Its dimensions are 18-in. by 22-in. by 42-in. and it is provided with an ammeter and voltmeter. They are also available in voltage ratings up to 48 volts and current ratings up to 6000 amperes. Remote control units are also made. Literature available.

Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif.



Switchboard (26)

A new interlocked stage switchboard for school, church, theatre, and other auditoriums. It is designed for operation on 3-phase, 4-wire, or single phase ac systems. Built on a freestanding, rigid-angle iron framework, it permits both individual and gang operation. All front panels are stretcher-leveled, steel-formed, with 1-in. return on all sides. A continuous lighting trough across top of front provides adequate light for operator. Dimmers are individual units of variable voltage auto-transformer type. They have circular toroidal wound coils and are accessible from front of board. Ventilation is provided by steel grilles. Each dimmer is equipped with a handle for individual operation which in turn can be interlocked with a group master lever.

Kelek Company, Norwood, Mass.

Lag Screw Shields (27)

Rawl lag screw shields have been added to this line. They are rust-proof, and precision-cast from a durable alloy. Horizontal fins prevent shields from turning in the hole. Tapered outside rings have tremendous holding power. Shields are made in a standard range for screw sizes from ¼-in. to ⅜-in.

The Rawlplug Company, Inc., 271 Church Street, New York 13, N. Y.

You get Unequalled Dependability with the PARAGON Memory Master TIME SWITCH

Moto-Vu operating window, permits instant check of motor operation.

Quick-change dial trippers. Add or remove dial trippers any time, easily and quickly.

"Torsion-Clutch" dial drive. Dial turns freely to permit manual check of "on-off" switch operations . . . yet has positive, no-slip drive.

"Quick-out" movement positively locks in case . . . no rattle. Movement swings right out when unlocked . . . with no loose parts.

New terminal block simplifies wiring — cuts installation time.

Terminal block insulator. Full depth terminal block insulator.

CHECK ITS "LOOK-AHEAD" FEATURES

Here's unequalled quality in 24-hour time switches for controlled billboard lights, store illumination, poultry house lighting, stoker operation and hundreds of other applications. Wherever you need automatic "on-off" control, the advance-designed 3000 Series gives you a maximum range of adjustability — up to 16 operations per day. Ask your distributor to show you this great new switch. Compare. Then, you'll see why the beautiful Memory Master is the talk of the trade.

THE BEAUTIFUL PARAGON 3000 SERIES

From $10.50 list

THE SWITCH THAT REMEMBERS . . . AND LETS YOU FORGET

PARAGON ELECTRIC COMPANY

1614 TWELFTH ST., TWO RIVERS, WISCONSIN

With G-E vertical lift, you can see when the breaker disconnects

Maximum safety to operator and equipment is provided. Mechanically operated shutters of insulating material close off disconnect openings when breaker is lowered. Stationary contacts are never exposed, present no safety hazard. Shutters open as breaker is raised, permitting entrance of breaker studs.

On G-E Metal-clad Switchgear—

1876 75 1950 YEARS OF ELECTRICAL PROGRESS

New safer, fast-action elevating mechanism can raise or lower breaker in 30 seconds

Vertical-lift design isolates breaker, simplifies inspection

Smooth, practically effortless raising or lowering of the breaker in General Electric's improved metal-clad switchgear, whether for inspection or test . . .

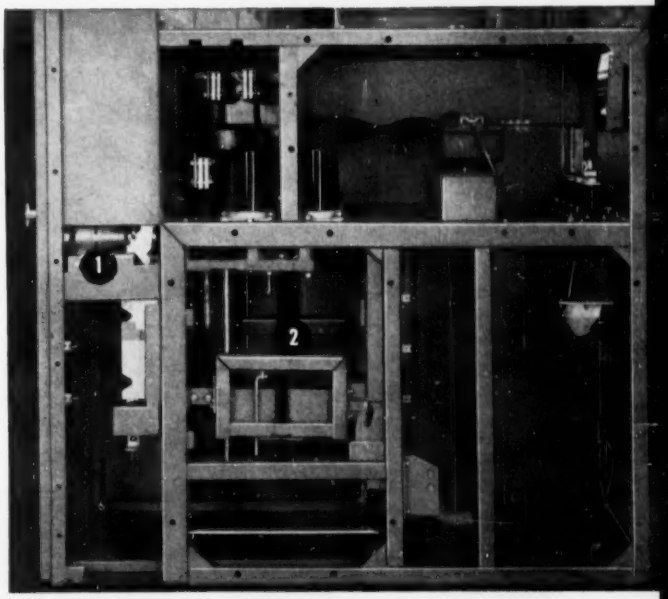
That is what you get with one of the simplest elevating mechanisms possible for the job: two jack screws—a sturdy cross chain drive—a compact gear motor with operating switches.

POSITIVE-ACTING MECHANICAL INTERLOCKS assure speedier operation. An interlocking system effectively blocks raising or lowering a "closed" breaker. In the operating position, the circuit breaker is locked in, preventing downward movement caused by even the most severe vibration. All parts of the elevating mechanism are accessible at front of the compartment, with the motor easily demountable for hand-crank operation.

BESIDES THESE ADVANTAGES of the new, faster-acting breaker-elevating mechanism, you also get full benefits of G.E.'s basic vertical-lift design. You can—

- See when breaker is isolated and breaker studs separated from main stationary contacts. Mechanically operated shutters close off disconnect openings to protect operator.
- Close the door with breaker in lowered position.
- Make most inspections and tests with breaker just lowered—not removed from compartment.
- Save time and energy, as mechanical lift makes removal of breakers convenient and easy.
- Gain quick, easy access to breakers in outdoor installations—especially on roofs where catwalks make other types of breaker removal inconvenient.

FOR THE COMPLETE STORY on G-E Vertical-lift Metal-clad switchgear, with ratings up to 13.8 kv, 500 mva, write for GEA-5664-A, Sect. 874-4, General Electric Company, Schenectady 5, N. Y.



NEW ELEVATING MECHANISM is shown in breaker with side plates removed. Compact gear-motor (1) in front of the compartment drives simplified jack screw mechanism (2) to raise breaker.

VERTICAL-LIFT DESIGN proves invaluable in outdoor switchgear installations—enables personnel to disconnect and inspect breakers easily in spite of gravel or other obstacles.

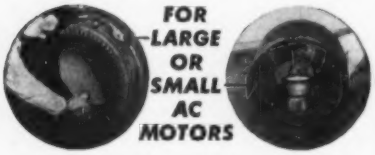
You can put your confidence in—

GENERAL ELECTRIC

Now Find ANY COIL SHORT Instantly!

the New CROWN INTERNAL GROWLER

- **POSITIVE**—no chance for error
- **FAST**—"Pinpoints" exact location of shorts
- **EASY**—Anyone can use it
- **CHECKS**—Stators, 6" ID up—Armatures, 6" to 14" dia.—Rotors, for loose bars



Does away with wasted time and guesswork of hacksaw blades or vibrating reed type testers. Self-contained meter and pick-up check each coil as it is excited—once around armature, stator or rotor locates all shorts. Finds shorts that give too weak an indication to be found by other means and reveals them with a definite movement of the meter needle. Operates on 115 V, A.C. Built to highest standards of dependability and accuracy.

$37.30 F.O.B. WOODSTOCK, ILL. State or local sales tax extra

ORDER NOW PROMPT DELIVERY

CROWN INDUSTRIAL PRODUCTS COMPANY
719 Amsterdam St., Woodstock, Ill.

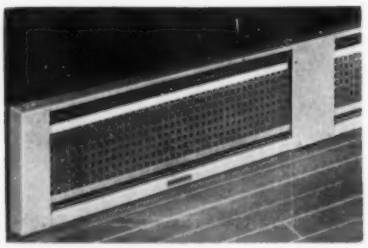
Send _____ CROWN Internal Growlers at $37.30 each.
☐ CHECK ENCLOSED. Amount $_____
☐ Send on P.O. Number_____
☐ Send only FREE Illustrated Catalog Sheets now

NAME.....
COMPANY.....
ADDRESS.....
CITY.....ZONE.....STATE.....

Step Ladder (28)

"Automatic action" safety step ladder may be rolled to desired position but as soon as a person steps thereon the casters automatically disengage making the ladder immovable. Rubber tipped legs "lock" to floor, providing a firm base. When a person steps off the ladder the casters automatically re-engage. Ladders are designed for use in industrial plants, school shops, garages, stock rooms, warehouses, file departments, bank vaults, libraries, as well as in all types of offices. Aluminum-finished steel is used. Frames are of ¾-in. steel tubing. Reinforced expanded steel make up non-slip step plates. The larger four and six step models are furnished with handrails.

Precision Equipment Co., 3714 N. Milwaukee Ave., Chicago 41, Ill.



Radiant Heat Panels (29)

Radiant ceramic baseboard heaters combine all the features of the wall-mounted and portable Heatmore models. The heating element is imbedded inside the ceramic panel. They are recommended for use under picture windows, or wherever wall space is limited. Each baseboard panel is rated at 2.8 amps, 115 volts, is 26-in. long, 8-in. high and 1½-in. deep. They are so constructed as to be mounted at the baseboard of a wall in continuous runs, depending upon heating requirements. Brochure is available.

Heatmore, Inc., 738 Broadway, New York 3, N. Y.

Instrument (30)

An improved insulation resistance test set called "Megohmmeter". Improvements include rugged casing and components, easier drive mechanism, freewheeling generator clutch, and separate Alnico magnets for indicator and generator. Model 5G-1000, reading to 1000 megohms, is 500-volt self-powered, and meets U. S. Government specification MIL--M-15023. Other models, either with lower ranges, dual ranges, or requiring external power supplies, are also available.

The Winslow Company, 9 Liberty, Newark, N. J.

Charger (31)

Selenium charger is especially designed for float charging batteries. Charger is full wave, automatic self regulating reactor controlled. It varies charging rate proportionate with requirements of battery. In operation it will maintain a battery at its correct voltage, 2.15 volts per cell, within approximately plus or minus 1% under any condition of charger load within 10% to full load current at normal 35°C ambient temperature. It will also compensate for an ac line variation of plus or minus 5%.

Richardson-Allen Corporation, 116-15 Fifteenth Ave., College Point, L. I., N. Y.

Beam Clamp (32)

A new, heavy gauge pressed steel-plated beam clamp. It fits up to ½-in. thick beam flange, has three ¼-20 tapped holes. It comes complete with case-hardened set screw. Maximum jaw opening is ⅝ inch, base width ¾ inch.

Blackhawk Industries, Dubuque, Iowa.

FLEX-A-POWER

Busway Distribution Systems

FLEX-A-POWER means permanent modernity of a building's electrical distribution system — complete freedom to change layout, add or move equipment, rearrange circuits and make building additions at minimum cost. Hundreds of modern plants have adopted it.

Now *Aluminum* Flex-A-Power gives you all the advantages of copper Flex-A-Power, including low voltage drop, *with up to 35% less weight.*

This means easier handling and installation, less expensive hanging, lighter floor loading.

Now the margin of Flex-A-Power superiority is greater than ever. Your Trumbull Distributor, working with Trumbull engineering, can give you authoritative information, prompt quotations and speedy delivery. Call him, or write us for Bulletin TEC-21.

Quick Facts ABOUT *ALUMINUM* FLEX-A-POWER

***TYPE FVK.** A plug-in busway with power outlets at one-foot intervals, tapped by Flex-A-Plugs of the fusible switch or molded case circuit breaker types. 225-800 amperes, to 600 volts. (3-phase 4-wire 277/480 volt type available in 225 and 400 ampere ratings.)

***TYPE LVD.** For high capacity, low voltage drop, feeder applications, or as a riser in multi-story buildings carrying high currents over long distances, 600-4000 ampere ratings, to 600 volts.

*Also available with copper bus bars. Light- and heavy-duty trolley busways available with copper bus bars only.

Listed by Underwriters' Laboratories, Inc.

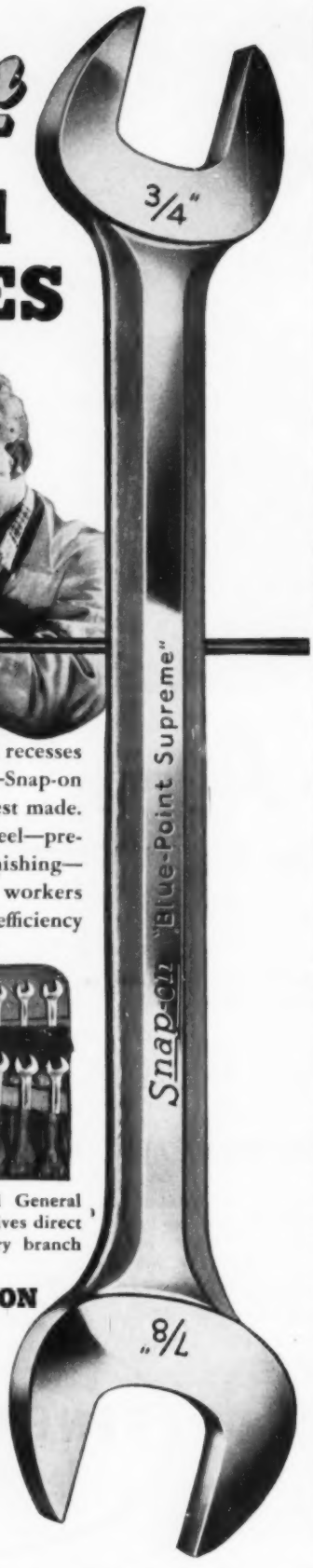
GENERAL ELECTRIC

DISTRIBUTION ASSEMBLIES DEPARTMENT
PLAINVILLE, CONN.

Snap-on*

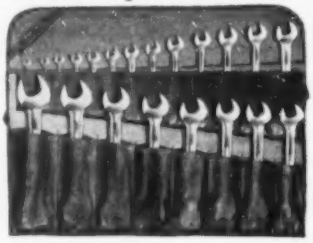
"Blue-Point Supreme"

Open End WRENCHES



For jobs like this—or where nuts are set in recesses too narrow for other types of wrenches—Snap-on open end wrenches are the strongest, safest made. Every detail of design—the tough alloy steel—precision machining—heat treatment and finishing—are highest quality. In the hands of your workers Snap-on wrenches will contribute greater efficiency to assembly and maintenance operations.

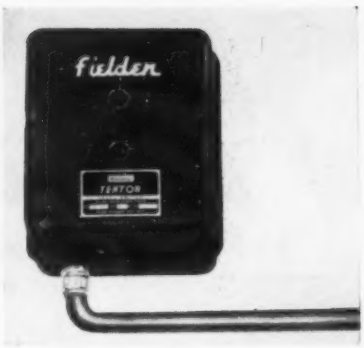
OE-821-K.
21 WRENCH SET
In kit as illustrated. Contains all standard sizes, ¼" to 1⅜". Most sizes duplicated on different handles to meet requirements of many jobs.



Write for Snap-on Industrial Catalog and General Catalog of 4000 hand and bench tools. Snap-on gives direct service to industry everywhere through factory branch warehouses in principal industrial centers.

SNAP-ON TOOLS CORPORATION
8048-K 28th Avenue, Kenosha, Wisconsin

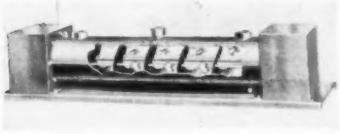
*Snap-on is the trademark of Snap-on Tools Corporation



Control (33)

New Tektor level control is an improved capacitance unit with no moving parts. Simplified electronic circuit operates by a change in electrical capacitance of electrode caused by approach of any material that flows. Instrument provides control as close as $\frac{1}{16}$-in. of liquid, divided solid, interface, conducting or non-conducting, wet or dry materials. Electrodes are available for use with pressures up to 2000 psi, temperatures up to 1500°F. Models 101 and 102 feature trimmer adjustment, accessible without removing cover. Instrument operates on 115 volt 60 cycle circuit.

Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33, Pa.



Sterilizer (34)

An industrial water sterilizer capable of handling quantities up to 7,000 gallons per hour. It weighs 95 pounds and operates on 110 volts, 60 cycle ac. It operates by guiding water by helical baffles into contact with a number of Westinghouse Sterilamps, which emit germ-killing ultraviolet rays. Lamps have a 6,000 hour life and stainless steel sterilizer is designed for ease of maintenance and lamp replacements. It is applicable to those industries which use large quantities of sterilized water such as dairy, brewing, bottling, and pharmaceutical.

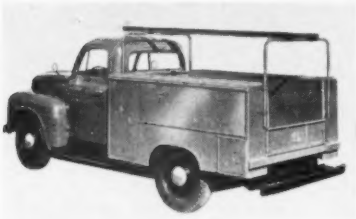
Aquafine Company, 1005 South Santa Fe Ave., Los Angeles 21, Calif.

AC Outlet (35)

A miniature ac outlet, complete with leads tailored to customers' specifications is now available to firms wishing to add customer convenience by building an ac outlet into their products. These outlets all use the same mounting holes dimensions, 1½-in. centers, and take less than 1-in. behind panel. New design has a single mounting plate of cadmium plated steel that mounts by production methods of spot weld, rivets or screws. Built-in

leads come in standard length 12-in., free ends stripped and tinned, or special lengths tailored to customer's specifications.

Alden Products Company, 117 North Main St., Brockton 64, Mass.



Service Bodies **(36)**

A new line of stranded service bodies for installation on ½, ¾ and 1-ton truck chassis, and construction units for 1½-ton and larger chassis. Model S-48 features a 48-inch bed width. It is also available with optional sliding cover and endgate enclosure for enclosing work area. Flush, pull-out type door handles with slam-action catches and master-keyed cylinder locks are used. Body has an anti-buckling, heavy-duty corrugated steel floor with drainage outlets. Top panels are ribbed. Buyer has a choice of side-angle or overhead type ladder rack as standard equipment, but, if neither is required, cost is deductible. Model S-48 has a body length of 90 inches; S-60, 104 inches; S-40, 75 inches. Literature available.

Utility Body Company, 1530 Wood St., Oakland 7, Calif.

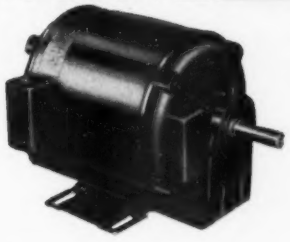
Heat Panel **(37)**

ThermoRay is a wall heater which emits radiant heat and also creates a flow of warm air. It is a permanent unit which attaches to or recesses into the wall, and is for installation in old and new buildings. Each room or zone is thermostatically controlled. Available in wattage ratings of 750 and 120 for operation on 115 or 230 volts. Approved by Underwriters' Laboratories. Heat panels are also available for a variety of applications, including ovens, food warmers, aquariums, motor armature drying and other purposes.

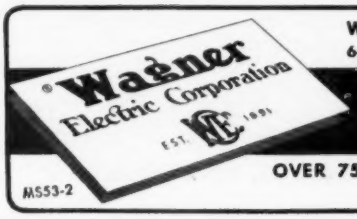
ThermoRay Corporation, 141 East 44th St., New York 17, N. Y.

Today—due to constantly rising labor costs—it usually costs you less to replace armatures in fractional hp. motors with Wagner Standard Rotors than to rewind the old ones. There's no guesswork involved—the "tell all" label on the Wagner Rotor Carton, used with the K and M "spec" lists, shows you the *right* replacement unit everytime. If necessary, the shaft can be removed from the standard armature and your special shaft used instead.

it's also wise...and profitable to stock **Wagner** *replacement motors*



Carry a stock of Wagner motors—to replace motors "too far gone" for economical repair and for emergency use where your customer needs immediate service. You'll find it pays off—and you can often make a ready sale.

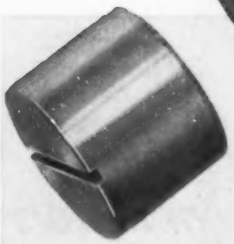


WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U. S. A.
MOTORS · BEARINGS · STANDARD ROTORS
BRUSHES · CAPACITORS · COMMUTATORS
MS53-2
OVER 750 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

Monarch

"FLOWS" BRASS to FIBRE to give you a QUALITY FUSE with LONGER LIFE!

Threaded Brass Ferrule Fitting "Flows" to Fibre Tube under great pressure for perfect junction. No rivets to weaken tube as in other fuses. No exposed brass inside barrel.
Monarch
60
UND. LAB., INC. INSPECTED FUSE

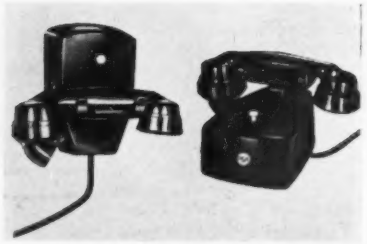


Monarch is the only fuse with this new construction feature. Fibre barrels cannot loosen from brass fittings. There are no rivets or pins to cause hot spots and char the fibre barrel. It means you get a quality fuse with better protection . . . over a longer operating period . . . and at the regular fuse price.

Ask your wholesaler now or write for further information.

Monarch Fuse Co., LTD.

Jamestown, New York



Intercom System (38)

A new low-cost telephone-type intercommunications system called the "Duo-Com" and designed for use in homes, professional offices, farms, schools, business and industry. The system provides instant natural voice communication and will operate more than a year on a single six-volt battery. Contact between phones is made by lifting receiver and depressing a button. At home, the system provides instantaneous contact with sickroom, nursery, workshop or other parts of the house. On farms it provides ready communications between buildings.

Radio Corporation of America, Camden, N. J.

Wiring Devices (39)

A new line of safety Unilets for hazardous locations. They feature new design thinking in explosion-proof, dust-tight and rain-tight circuit breaker, motor starter and combination line starter Unilets. They lend themselves to easy, safe and economical field installation in such hazardous locations as: Class I, Group D (NEMA Type VII); Class II, Groups E, F and G; Class III (NEMA Types IXA, IX, V and III).

Appleton Electric Company, 1701 Wellington Ave., Chicago 13, Ill.

Connector (40)

Three new sizes of "Scotchlok" electrical spring connector for making splices in electrical wiring. Listed by Underwriters Laboratories, they are expected to find wide usage for making splices in circuit wiring and for fixture hanging and appliance hook-up. Made of zinc-plated steel wire in the form of a tapered coil spring, the lubricated connectors are screwed on stripped ends of wires with fingers. A notched turning stem provides adequate leverage during application and is then snapped off leaving a neat splice with no sharp ends. Recommended insulation for use with connectors is

"Scotch" plastic electrical tape No. 33 providing a water-and-oil-resistant splice.
Minnesota Mining and Manufacturing Co., St. Paul, Minn.

Transformer (41)

A new constant-current street lighting transformer, designed to permit direct pole mounting of models up to and including 20 kw size. Designated G-E Type R02, it permits easy adjustment of weights, without removing transformer cover, through an outside handhole located above transformer's oil level. Covers can be removed easily by loosening one bolt holding clamp band. Cable connections can be made without tools by inserting cable from either direction into bushing and tightening insulated hand wheel. Design permits use of any type of lamp load-filament, sodium vapor, mercury vapor or fluorescent.
General Electric Company, Schenectady 5, N. Y.

Combination Switches (42)

A new line of combination switches featuring single pole switch and receptacle with "T" slots. Combined with a heavy duty T-rated switch the "T" slot receptacle has double wipe contacts. Switch and receptacle are independent of each other on same circuit. It has a bakelite housing, reinforced with steel strap and will fit standard duplex wall plates. Listed by Underwriters' Laboratories and CSA approved, the No. 798 is available in brown or ivory.
Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza South, Long Island City 1, N. Y.

Reflector Lamp (43)

A new R57 reflector lamp for industrial high bay lighting applications. It is a complete luminaire. Available in 500 and 750 watts, has a hermetically sealed internal reflector made of silver. With a rated life of 2000 hours, the engineering design prevents dust and grime from setting on under surface of lamp and obscuring light emission. Lamp is recommended for "smog" areas in plants where cleaning lamp reflectors is a constant maintenance problem.
Amplex Corporation, 111 Water St., Brooklyn 1, N. Y.

Use Blackhawk BENDERS anywhere —they're really portable!

Electrician works comfortably from ladder using Blackhawk S-34 to bend 1½" thin-wall.

Fast, versatile and so easy to use — Blackhawk Benders speed every job!

Yes, sir, you can pump from any spot — on the floor, on the bench or up on a ladder — even while you're moving around! That's because with Blackhawk "Porto-Power" Pipe Benders the hydraulic pump is separated from the bender by a flexible safety hose.

But that's only one of the big "dollars and horse sense" reasons why so many contractors choose Blackhawk Benders to speed their work. Models are available for any popular size conduit, rigid or thin-wall. Then, too, they can use the same Blackhawk "Porto-Power" hydraulic jack for hundreds of lifting, pulling or pushing jobs.

Order Blackhawk Pipe Benders from your Electrical Wholesaler or Industrial Supply Distributor. Find out for yourself why crews that have a choice of Benders almost unanimously choose Blackhawk. Write for Catalog 50B.

S-36 Kit: For 1¼" to 4" dia. Rigid Conduit and Pipe

S-34 Kit: For 1¼" to 2" dia. Thin-Wall Conduit

S-30-A Kit: For 1" to 2" dia. Rigid Conduit and Pipe

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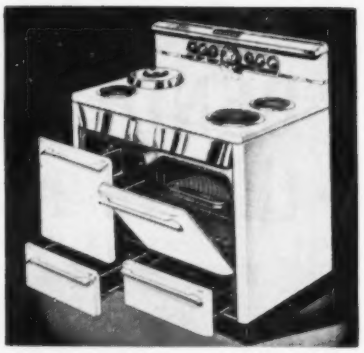
Blackhawk Mfg. Co., Dept. P-20113 • Milwaukee 1, Wisconsin

WOW!
I've just seen the new Toledo Products

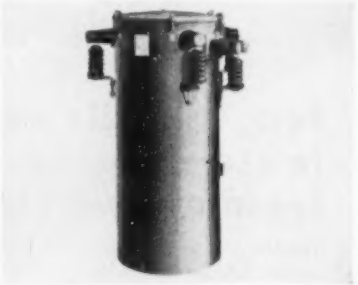
Watch for BIG NEWS
coming soon from—
TOLEDO
THE LEADER—PIPE TOOLS • POWER PIPE MACHINES • POWER DRIVES
THE TOLEDO PIPE THREADING MACHINE CO., Toledo, Ohio



Electric Range **(44)**

New Model L-406 electric range, called "Light-Director", features a chromium lamp which extends entire width of range. There are four surface units, with capacities from 1250 to 2100 watts, including the auto-lift deep-well cooker. Operation of the "Flavoramic" oven is automatic. It has a waist-high food-warming drawer, controlled by a 400-watt heat unit with manual switch.

Perfection Stove Co., 7609 Platt Ave., Cleveland 4, Ohio



Transformer **(45)**

A new constant current transformer, type CSPH-K, for cascade service in street and highway lighting systems. This oil-insulated, self-cooled automatically-controlled unit will prevent current from varying more than 1% from its rated value under all conditions of loading within the rated capacity of transformer. Available in ratings from 5 to 30 kw, 2400- or 4800-volt primary, 6.6- or 20-ampere secondary, 60 cycles.

Westinghouse Electric Corp. Box 2099, Pittsburgh 30, Pa.

Product Briefs

(46) Bantam model propane **torch** has been added to the Bernz-O-Matic line. It is manufactured by Otto Bernz Company, Inc., Rochester, N. Y. . . . . (47) A-Glass is a new **varnished glass cloth** announced by Electro-Technical Products Division, Sun Chemical Corp., 113 E. Centre St., Nutley 10, N. J.

(48) Castohm, is a new type of fixed wirewound power **resistor** developed by the Shallcross Manufacturing Co., Collingdale, Pa. . . . . (49) **Sil-X,** the first UL-approved glass-braid lacquered wire with General Electric's SE-460 silicone rubber insulation, is now being produced by the Essex Wire Corp., Ft. Wayne, Ind. . . . . (50) Morrison Products, Inc., 16816 Waterloo Road, Cleveland 10, Ohio, announced a line of direct drive **blowers** for manufacturers of forced warm air furnaces and air conditioners.

(51) Control Products, Inc., 300 Sussex St., Harrison, N. J., has announced production of a new **thermal sensing unit,** for use wherever temperature limit indication is required. . . . . (52) A new **thermostat,** called Tri-Snap, for quick-make and quick-break close temperature control is available from Westinghouse Electric Corp., Pittsburgh 30, Pa. . . . . (53) A new **masonry bit** display assortment is being marketed by the Black & Decker Mfg. Co., Towson 4, Md.

(54) Ideal Industries, Inc., Sycamore, Ill., has developed a new thermo-tip **soldering tool** for production and repair work. . . . . (55) A portable power **hack saw,** called the Hand-I-Hack, makes angular cuts in any position. It is manufactured by Lipe-Rollway Corporation, Syracuse, N. Y. . . . . (56) Contact, Inc., 238 Main St., Cambridge, Mass. announced the production of Wire Wrench, a new **tool** for wrapping wire around terminals.

(57) A new 7-in. portable **saw,** called "Power-Guide", will mitre a 2-in. plank at 45° and has a shoe adjustment for slotting from ¼ up to 2⅞-in. deep. It is manufactured by the Ram Tool Corp., 411 N. Claremont Ave., Chicago, Ill. . . . . (58) The Barry Corporation, 700 Pleasant St., Watertown 72, Mass., has developed vibration isolation **bases,** called Barrymounts. . . . (59) Phillips Manufacturing Co., Inc., 2816 Aldrich Ave. South, Minneapolis 8, Minn., has introduced a new Model 250 Versa-Tool instant heat **soldering gun.**

(60) Producers and Distributors, Inc., 714 South Sixth St., Allentown, Pa., has announced a new portable **power saw** with a 360° rotability. . . . . (61) A new line of room **air conditioners** in ½, ¾ and 1 ton models have been introduced by **Emerson Electric Mfg. Co.,** 8100 Florissant Ave., St. Louis 21, Mo. . . . . (62) A new presplice **cutter** for copper and all-aluminum strand has been announced by the Interstate Drop Forge Co., 4051 North 27th St., Milwaukee 16, Wis.

(63) Arrow Fastener Company, Inc., 1 Junius St., Brooklyn 12, N. Y., has added a new feature to their **T-50 gun tacker,** designed to expedite electrical wiring jobs. . . . . (64) Monarch Fuse Company, Jamestown, N. Y., has developed a process for securing ferrule fitting to the fibre barrel on 30 and 60 ampere ferrule renewable **fuses.** . . . . (65) New standardized types of hermetically-sealed lug-type, lead-thru **insulators** available. Electrical Industries, 44 Summer Ave., Newark 4, N. J.

As fundamental as hidden pipes...

No electrical contract is really complete unless it contains raceways for telephone wires.

Covered-up pipes and built-in telephone raceways are two concessions to people's ideas about how rooms should look. More and more home buyers want their telephone wires kept behind the scenes.

By including telephone raceways in your contracts, you make the homes you wire more salable for the builder, more attractive to the buyer, more profitable for yourself.

Make this "extra" your source of "extra profits" on every job.

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KLEIN

Talk to any old-timer on the job and he'll tell you Klein equipment is his choice for comfort—for safety—for service. Look for the familiar Klein trade-mark on pliers, safety straps and belts, climbers, grips and wrenches. Klein has been serving the electrical industry "Since 1857."

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Write for your free copy of the Klein Pocket Tool Guide today!

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Catalogs, Bulletins and Engineering Data

(66) CRANE-DRIVE EQUIPMENT; cutaway and exploded views of dc crane motors and controls; typical speed-load and performance curves; description of built-in magnetic brake. 12-page bulletin. General Electric Co.

(67) VAPORPROOF LIGHTING FIXTURES including weatherproof floodlights, residential floodlights, and shower lights. New and completely revised catalog. Rab Electric Mfg. Co., Inc.

(68) PROCESS CONTROL DATA BOOK describing complete line of thermocouples, radiation detectors, recording instrument protection tubes and lead wires, and resistance bulbs; specifications, dimensions, illustrations and prices. 40-page catalog. Barber-Colman Co.

(69) POWER TOOL BENCHES in two sizes for mounting the standard line of small power tools; adjustable for width and height. 4-page brochure. Morrison Products, Inc.

(70) CONDUIT AND EMT system planning and expansion; graphically-illustrated 24-page educational booklet describing safety, adaptability and dependability of conduit and electrical metallic tubing for use in homes, farms and factories. National Electrical Manufacturers Assn.

(71) PORTABLE ELECTRIC GENERATORS for emergency electric power; lightweight carryable units for industry, homes, farms, hospitals and institutions; specifications, electric output data and prices. Homelite Corp.

(72) TEST INSTRUMENT; high-voltage dc Hypot for testing ignition harness, electrical machinery, cables, control circuits, transformer windings, and similar equipment; ranges of 0-5000 volts dc and 0 to 5, 10, 50 and 100 microamperes; illustration, description and specifications. Associated Research, Inc.

(73) CURRENT-LIMITING REACTORS for single and three-phase circuits of 34,500 volts and below; cast in concrete with copper or aluminum conductors. 8-page bulletin. General Electric Co.

(74) MERCURY VAPOR LAMPS for street lighting, industrial high-bay illumination, outdoor floodlighting, black light applications, photography and photo engraving; photographs, complete technical data and operating characteristics. 4-page bulletin. Amplex Corp.

(75) KEY SWITCHES and other control devices including limit switches, lamps, jacks and caps, rectifiers, fuses and impulsing devices for industrial use; specification tables, photographs and diagrams. 30-page catalog. Automatic Electric Co.

(76) FLUORESCENT BALLASTS; principles of design; testing procedures; data sheets; installation and operation section. 20-page catalog. Advance Transformer Co.

(77) ELECTRONIC CONTROLS for the solution of industrial problems; factual data and explanatory diagrams on counting, weighing, measuring, timing and cycling. 46 case studies. Photoswitch Inc.

(78) RUBBER MILL DRIVES using totally-enclosed air and water-cooled Banbury mixer motors, synchronous, squirrel-cage or wound-rotor; descriptions, photographs and cutaway views. 4-page bulletin. General Electric Co.

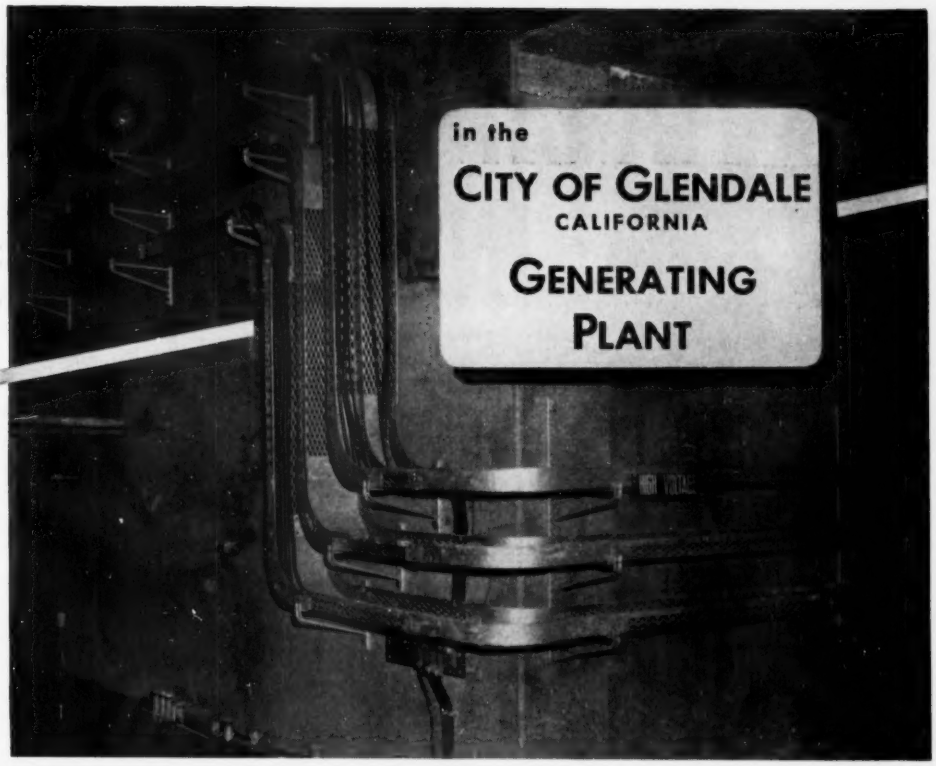
(79) V-BELT DESIGN MANUAL; selection of V-belt drives; new V-belt industry numbering system plus numbering systems of each major V-belt manufacturer. 52-page manual. Boston Woven Hose & Rubber Co.

(80) TUBULAR STEEL SCAFFOLDING; illustrations of various panel styles; description of panel and brace assembly method using cam and stack locks. 6-page color folder. Beaver Art Metal Corp.

(81) WATTHOUR METER SOCKETS; selection, installation and connection of round die-cast types for single-phase meters, box-type for standard polyphase and high-capacity single- and polyphase meters; connection diagrams and reference tables. 20-page bulletin. General Electric Co.

(82) CIRCUIT BREAKERS for 2, 3 or 4-wire service; surface- or flush-mounting types available for indoor or outdoor installations; photos, specifications, description of operation. 4-page bulletin. Wadsworth Electric Mfg. Co., Inc.

(83) ANNUNCIATOR SYSTEMS; automatically and continuously self-supervised circuit for industrial alarms; typical wiring diagrams and



Cope CABLE TROUGH AGAIN PROVES ITS

... Simplicity of Installation
... All-around Economy
... Accessibility to Cable

The versatility and simplified design of the Cope system of Cable Trough and Fittings make it readily applicable to any layout. This is clearly seen in the above photograph showing part of a recent installation at the Glendale Generating Plant. Notice how the Cope Trough is supported by simple wall brackets. Observe, too, that both vertical and horizontal runs are made with standard trough and fittings — turns, branches and reductions.

The High Voltage sign on the top tray emphasizes another Cope Trough feature. Here 480 volt Neoprene jacketed power cables are carried in the same tray with control cables. A barrier strip provides adequate separation while permitting easy access to the lines. The lower tray will carry 2400 volt Neoprene jacketed power cables and ultimately will be equipped with a solid Cope Trough cover. Future expanding needs will be met by adding a fourth tray above the other three.

Learn how you, too, can cut cable installation costs and labor . . . write for bulletin on Cope Cable Trough.

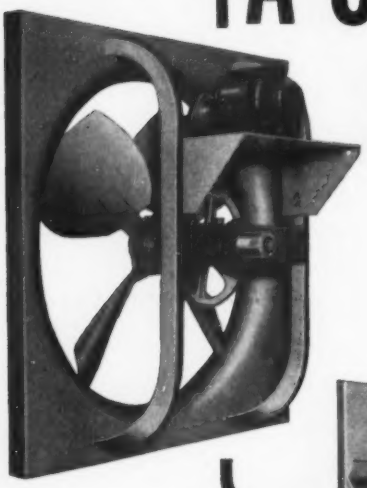
T.J. Cope INC.

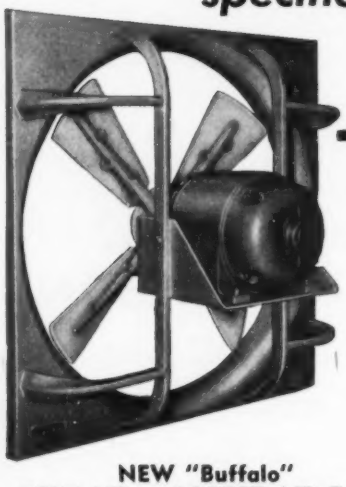
You know Cope by these products

711 SOUTH 50th ST., PHILADELPHIA 43, PA.

A CINCH TO INSTALL

—and sure to perform as specified





• *Above, the attractive new Belt-Air Wall Panel Fan*

• *Right, the new, highly versatile "Buffalo" Type "NV" Heavy-Duty Design 80 Propeller Fan*

"Buffalo" FANS

NEW "Buffalo" BELT-AIR and BREEZ-AIR FANS

Major design changes in both wall panel Belt-Air Fans and Breeze-Air Attic Fans provide: (1) higher capacities at lower, quieter speeds and lower power consumption, (2) fan operation at any angle from horizontal to vertical, shaft-up, because of a new sleeve bearing design on fan shaft, in 24", 30" and 36" sizes; (3) quieter operation than ball bearing designs. Write for details on these rugged, easily installed package fans. Like all "Buffalo" Fans, their installed performance is as good or better than "on paper"—and that means more satisfied customers for you.

NEW "Buffalo" Heavy-Duty "NV" PROPELLER FANS

Talk about flexibility—you can operate these husky 4-bladed fans on either free air delivery or against pressures up to 1" with very stable performance and high efficiency. Pick either Direct or V-belt Drive, in sizes from 24" to 84", or 4,000 cfm to 90,000 cfm—a range of easily installed fans to handle any job you'll run into—to perfection. Write TODAY for Bulletins!

First For Fans

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PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

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PANEL BREEZO FANS · BELTED VENT SETS · BELT-AIR FANS
BREEZ-AIR ATTIC FANS · "L" BREEZO FANS · "NV" BREEZO FANS

dimensions. 6-page bulletin. Scam Instrument Corp.

(84) AUTOMATIC TIME SWITCH for control of street lighting, store windows, signs, refrigerator defrosting, and other industrial applications; design, operation, application, wiring diagrams and dimensions. 8-page bulletin. General Electric Co.

(85) TRANSMISSION LINE connectors, tools and accessories; descriptions of fittings for all applications, aluminum-to-copper connectors, hydraulic installing tools, hydraulic heads, hand pumps and safety devices; use and maintenance of transmission line tools. Thomas & Betts Co., Inc.

(86) POWER CABLES, rubber insulated, for use up to 35,000 volts; current carrying capacity tables, aluminum conductor conversion factors, formulas for calculating the effects of shielding, dimensional data on bare conductors; 29 pages of detailed drawings and instructions for splicing and terminating power cables, including straight, tee and trifurcating splices, ascending and descending terminations, and terminals with and without potheads. 128-page book. Okonite Co.

(87) FIBRE SLOT WEDGES for armatures; samples of 11 standard curve-formed wedges plus 10 square-formed sizes on card; to check a certain wedge for fit, projecting end of wedge may be inserted in motor slot. Data on wedge samples included in accompanying 4-page bulletin. Insulation Manufacturers Corp.

(88) OVERLOAD RELAYS for electrical circuit protection; description of hydraulic-magnetic operating principle; general dimensions and specifications; response curve giving time vs per cent load; details of typical application. 4-page bulletin. Heinemann Electric Co.

(89) ELECTRICAL TESTING INSTRUMENT Buyers' Guide; data on hook-on volt-ammeters and watt-meters, hook-on power factor meters, portable recorders, voltmeters and ammeters, phase-sequence indicators, hand pyrometers, surface roughness scales and insulation resistance meters; 16-page bulletin. General Electric Co.

(90) HOISTING EQUIPMENT including differential, screw gear and spur geared hand hoists and electric hoists of capacities from $\frac{1}{8}$- to 15 tons; Bulletin 1567. Yale & Towne Mfg. Co.

(91) STORAGE BATTERIES; educational booklet describes how a battery operates and how to keep it per-

forming at maximum efficiency throughout its life. 24-page booklet. Electric Storage Battery Co.

(92) RESISTANCE TESTERS; description and operating characteristics of the midget Megger insulation tester for most types of electrical apparatus, the constant voltage Megger insulation tester, and the midget Megger circuit testing ohmmeter for resistances of 0.1 to 200,000 ohms. 8-page bulletin. James G. Biddle Co.

(93) OIL-IMMERSED STARTERS for low-voltage motors in corrosive or hazardous gas locations; photographs and cutaway drawings illustrating maintenance and protective features; ratings and dimension diagrams. 8-page bulletin. General Electric Co.

(94) LIGHTING POLE BRACKETS, mast arms and accessories; design photos, drawings and data; construction specifications and mounting instructions for both wood and steel pole installations. Catalog 82. The Union Metal Manufacturing Co.

(95) GENERATING PLANTS: general information on selection of engine-driven generating plants; history of electric plant development; descriptions of alternating current, direct current, and battery charging plants; review of prime movers, cost of operation, comparison of differences of engine cooling. 33-page pocket-sized booklet. D. W. Onan & Sons, Inc.

(96) LIGHT POLES and brackets with standard anchor base and transformer base; cutaway and exploded views of component parts; erection data. 14-page catalog. Pacific Car & Foundry Co.

(97) INSULATING TRANSFORMERS, single and three-phase air-cooled; photos, technical specifications, primary and secondary voltage combinations; complete section of technical data sheets on transformer installations including wiring diagrams, illustrations and ampere ratings. Loose-leaf catalog. Precision Transformer Corp.

(98) ELECTRIC HEATER for portable use in small rooms; description, illustrations, applications and heater specifications. Two information sheets. Electromode Corp.

(99) LIGHTING GLASSWARE HANDBOOK: methods of estimating lighting intensities; methods of calculation of illumination using large area luminous elements, troffers, fluorescent and incandescent luminaires; tables of engineering data. 24-page book. Corning Glass Works.

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3 NEW ITEMS!

Now there's a Rawl-Product for top speed and safety on every job

Rawl Lag Screw Shields

Here is a completely rustproof precision-cast lag shield made of a durable alloy. Ideal for all masonry fastening, especially where "problem masonry" is encountered. Horizontal fins prevent shield turning in hole. Tapered outside rings have tremendous biting power.

Rawl Spring Wing Toggle-Bolts

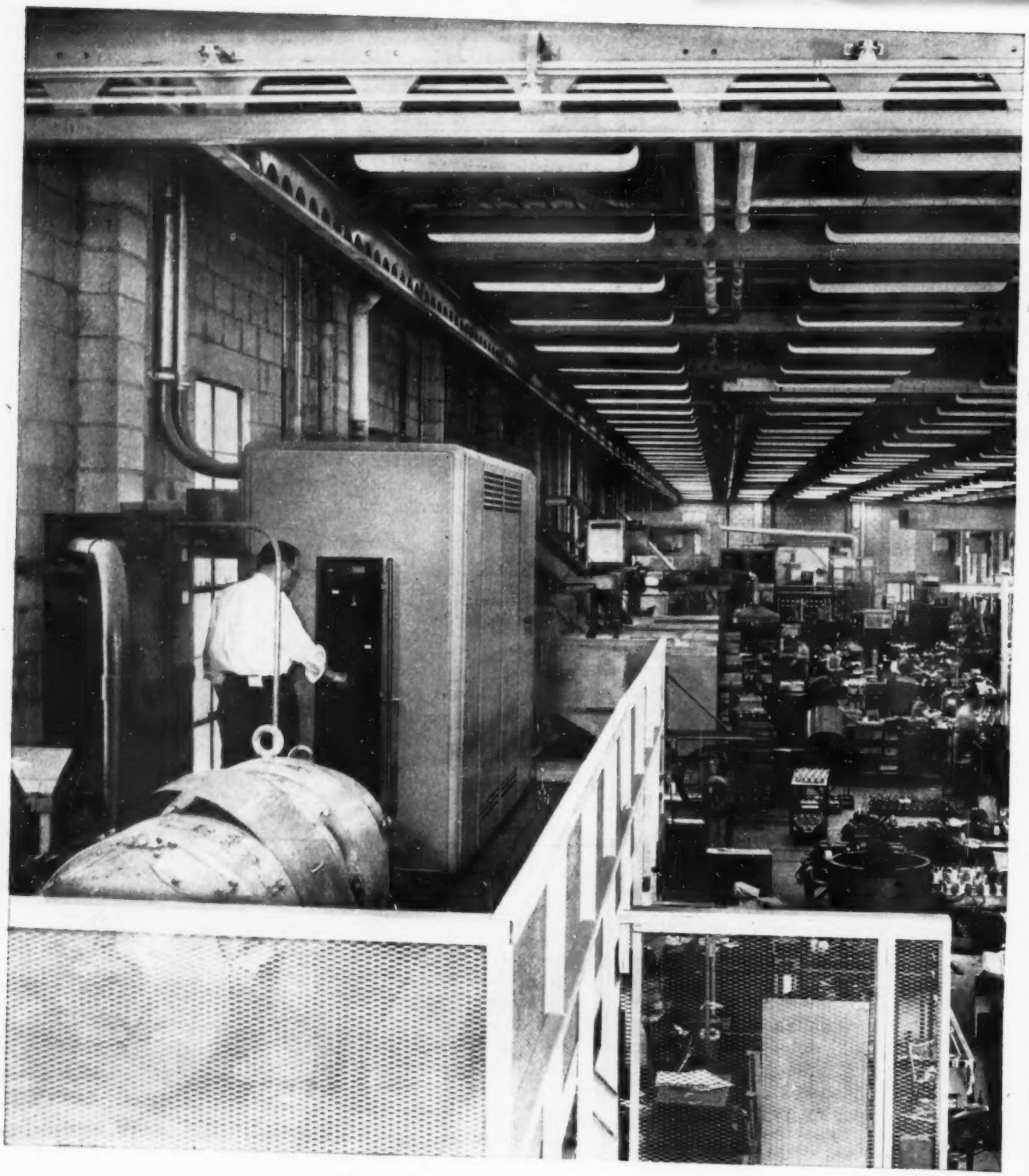
For utmost ease in fastening to hollow walls, pressed board walls, tile, sheet metal, etc., Rawl Toggle-Bolts are unsurpassed. They have positive, automatic spring action...are rust-proof...assure permanent security for fastening or suspending lighting and plumbing fixtures, cabinets and endless utility items.

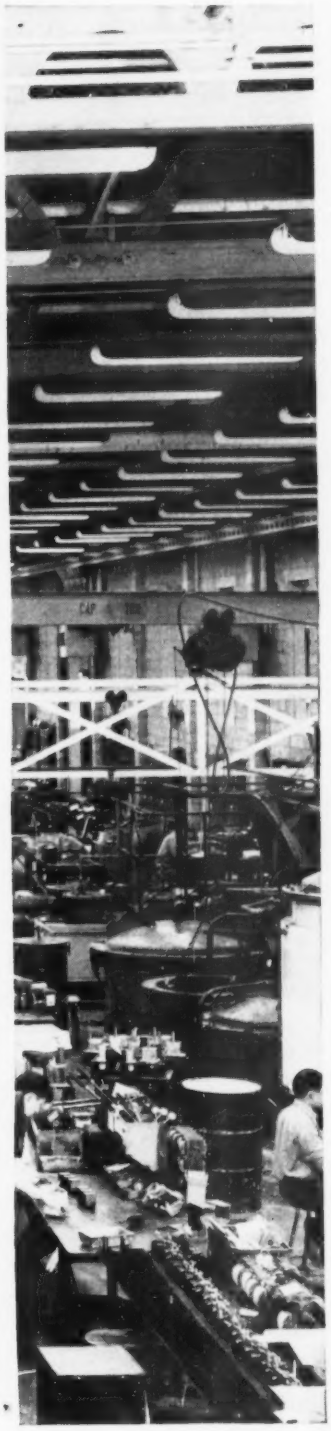
Rawl Handyman Kit

Everyone—householders, maintenance men—will find the Rawl Handyman Kit the perfect answer for a thousand and one anchoring jobs. The kit, packaged in an attractive plastic tube, contains twenty #8 x 1" Rawlplugs, assorted screws, screw eyes and screw hooks, one of the famous 3-point Rawl Drills, and complete installation instructions.

And remember—the complete Rawlplug line enables you to meet every anchoring requirement with lower installed cost and with positive, permanent holding power. Order Rawl-Products from your dealer.

THE
RAWLPLUG Co., Inc.
271 Church St., New York 13, N. Y.





Here's how Westinghouse power centers increase plant output...safely

Safe, efficient power distribution that actually helps increase plant output... that's what this Western Pennsylvania manufacturer realized by installing modern Westinghouse dry-type power centers.

Dry-type power centers minimize installation costs because they are completely safe. Since they are *both* fire and explosion resistant, they can be located right in the production area. They require no vaults, catch basins, toxic gas vents, or drains. Lightweight, they can be installed overhead, releasing valuable floor space for production. This makes it easier to locate them close to the load they serve, shortening secondaries, cutting line losses, improving regulation. The result: Increased production efficiency.

In the plant pictured at the left, two Westinghouse power centers divide the load. Capacity is provided in each to allow for expansion.

Add these up for your plant: (1) Safe, economical installations. (2) Increased production space. (3) Increased plant efficiency through improved regulation. (4) Savings in power cost through reduced losses. (5) Savings in heavy copper through shortened secondaries.

Westinghouse power centers can bring these advantages to your plant, too. Because they are factory assembled and coordinated as one unit, with components designed to meet your individual requirements, they can be installed quickly and easily. For further information, check with your contractor, your Westinghouse distributor or local representative, or write direct to Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.

J-70708

YOU CAN BE SURE...IF IT'S Westinghouse

Lady of Lourdes Hospital, Camden, New Jersey

IN HOSPITALS, TOO, IT'S *"Talk-Don't Walk"*

MODERN ARCHITECTURE—
MODERN INTER-COM SYSTEMS

Modern buildings of all types are wired for inter-com sound systems. Efficiency demands "Talk—Don't Walk."

The beautiful new Lady of Lourdes Hospital at Camden, New Jersey, has taken advantage of the permanence and trouble-free performance of Belden Inter-Com Cables for its built-in systems. Specifically, Belden No. 8743 is used for its under-pillow radio receivers.

There is a specialized Belden Cable for every inter-com or sound system requirement.

Belden Manufacturing Co., 4623-A W. Van Buren St., Chicago 44, Ill.

"Talk-Don't Walk"

For *Permanent* Installations

For Profitable Work

FOR EVERY TYPE OF INSTALLATION
FOR EVERY TYPE OF EQUIPMENT
BELDEN HAS THE CABLE BUILT TO
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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Repulsion Induction Motors

QUESTION C24—An account of ours has a Myers water pump with a 12-inch stroke belt driven by a 5 hp single phase repulsion induction motor.

The pump works hard and causes the brushes on the motor to wear down fast. The motor will not start, but hums very loudly.

The magnetic starter is in good condition and with a 28.0 amp. heater will not disconnect the power.

The motor hums for hours, gets very hot and the owner does not know about it till he finds he has no water.

Also in case of low voltage we find magnetic starters do not protect motors, but allow the starting coils to burn up or the holding coil in the starter will burn up.

Can your readers answer our problem?—D.W.

ANSWER TO C24—Repulsion induction motor brushes are used only during starting and do not carry current after the commutator short circuiting ring throws in. However, if the load is too heavy, the motor will never reach a high enough speed and will eventually burn out.

If you are connected to a 230 volt line, this 28 amp heater should trip when motor is operating under the loaded conditions you describe. A tong-test ammeter reading will indicate the degree of overloading. I suspect your heater is off calibration.

Some magnetic switches do not drop out when voltage is lowered. This is usually caused by the pole pieces being extremely smooth. Try roughening one face with a prick punch. Holding coils do not as a rule burn out unless the solenoid plunger sticks in the open position. Make sure the plunger is clean and has ample clearance for up and down travel.

If after you take the tong-test readings, you find the motor is overloaded, you may replace the motor or you may change the pulleys to reduce the speed. The latter will, of course, reduce the rate of pumping.—R.H.M.

ANSWER TO C24—The desirable combination of the high torque and low starting current of the repulsion with the constant speed characteristic of the induction motor has led to numerous designs which automatically shift from repulsion to the induction characteristic at about 2/3 of synchronous speed. The most usual type has some form of centrifugal mechanism which short-circuits the commutator bars at a predetermined speed. Therefore, the armature winding effectively becomes a simple squirrel cage, and the motor has normal single phase induction motor characteristics. Many such motors combine a brush-lifting mechanism with short-circuiting device, so that the brush noise and wear are absent during normal-load operation. The usual range of sizes is from ¼ to 5 hp at 1800 rpm, with starting torque of 300% to 600% of full-load value and are widely applied to drive compressors, pumps and other constant speed equipment.

A float switch, to determine the above water and low water levels, should be connected into the magnetic circuit of the starter contactor, to de-energize the motor from the line, into this, incorporate a signal light (two colors, high and low; and green to indicate motor running).

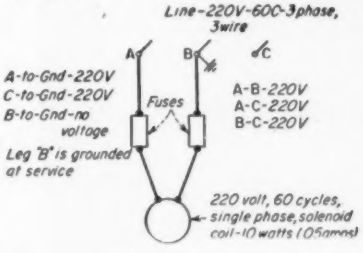
The thermals on the contactor should be 115% of the motor amps.

The motor centrifugal and short-circuiting mechanisms should be adjusted and freed of grit and grease, making sure the "neutral" is in the proper location and the brushes are clean.

On the magnetic contactor, an under-voltage release coil should be installed, to prevent the restarting of the motor should the line voltage get too low.

Protective Devices

QUESTION D24—In the diagram below is it necessary to fuse both legs? If so, why? Can plug fuses, time delay type, such as Fusetron or Fustats be used instead of cartridge type fuses? If not, why can't they be used? I do not think that a cartridge fuse can be purchased with a rating as low as .05 amps.—R.C.



ANSWER TO D24—The fuse in the grounded leg of the diagram is unnecessary because all possible faults will be handled satisfactorily by the fuse in the ungrounded leg. An overload or a short circuit on the load side of the fuse will cause it to blow opening the circuit. A fault to ground on phase "A" on the load side of the fuse also will blow the fuse clearing the circuit. A fault to ground on phase "B" is meaningless because it already is the grounded leg of the circuit.

The national Electrical Code prevents the use of plug fuses on the circuit shown because their use is limited to circuits of a system having a grounded neutral and no conductor at more than 150 volts to ground. In the circuit shown, the voltage to ground is 220 volts which exceeds the code requirements. The plug fuse, rated at 125 volts, might blow up under heavy short circuit conditions on such a circuit.

Fusetron dual element fuses in the NEC standard cartridge dimensions, rated at 250 volts or less and 600 volts or less, are commercially available in sizes from 4/100 amperes to 600 amperes. Sizes smaller than 1/10 ampere are considered special and normally are not stocked by the jobber. However, these sizes can be obtained upon request.—J.C.L.

ANSWER TO D24—It is not necessary to fuse the phase which is grounded in this diagram. Section 2401 of Article 240 of the National Electrical Code states:

". . . A grounded conductor is considered to be protected from overcurrent if a protective device of a suitable rating or setting is provided in each ungrounded conductor of the same circuit." Table 28 and diagram 14 of the Code substantiate this statement.

No type of plug fuses can be used. Since the voltage to ground across the fuse would exceed 150 volts to ground and the voltage between conductors would exceed 125 volts, plug fuses would be in violation of Section 2403-a of Article 240. Such voltages exceed

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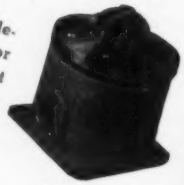

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that for which plug fuses are designed. Time delay type cartridge fuses can be purchased which will protect this solenoid if No. 14 copper conductors are used to supply current to it in accordance with the provisions of Section 1109 of Article 110 and Section 3103 of Article 310 of the National Electrical Code.—W.R.S.

ANSWER TO D24—The solenoid coil circuit is a single phase branch circuit, therefore under ordinary conditions and according to Section 2409 of the National Electrical Code, no fuse or overcurrent device should be inserted in the grounded leg.

Plug fuses are only rated up to 125 volts and insertion of one in this type of circuit would be hazardous and a violation to the N.E.C. In compliance with Section 2403-a of the Code, plug fuses are not allowed in circuits with 220 volts between conductors except circuits having a grounded neutral but with no conductor exceeding 150 volts to ground.

Fast acting and time delay cartridge fuses of non-standard sizes are manufactured by several companies with ampere ratings of .031, .063, .10, .15 etc. For this problem, the Buss Fusetron, symbol MDL, 250 volts, ⅛ amp or Buss fuse, type MJW, 250 volts, ⅛ amp made by the Bussman Mfg. Co., University at Jefferson, St. Louis, Missouri can be used very conveniently.

Also available by Littlefuse, Inc., 4757 North Ravenswood Ave., Chicago 40, Ill. is their Cat. No. 312.062, 250 volts, ⅛ amp or Cat. No. 318.062, 250 volts, ⅛ amp. Naturally these fuses require their own fuse holders.—R.M.

Bearings on Motors

QUESTION E24—It has been claimed by operating engineers that having the air gap at the top and bottom of the rotor or armature will eliminate most of the wear on the bearings by causing the shaft to center in the bearings instead of resting on the bottom of bearings when rotating. What percentage of motors in use utilize this method? Just how much difference in air gaps should there be when the armature or rotor is not moving? Is it necessary to add or take off any turns from the field, armature or stator or add any device to cause the attraction of the rotor or armature to the upper part of the motor, or will just the proper adjustment of air gaps do this?—E.B.

ANSWER TO E24—I have never heard of electrical manufacturers

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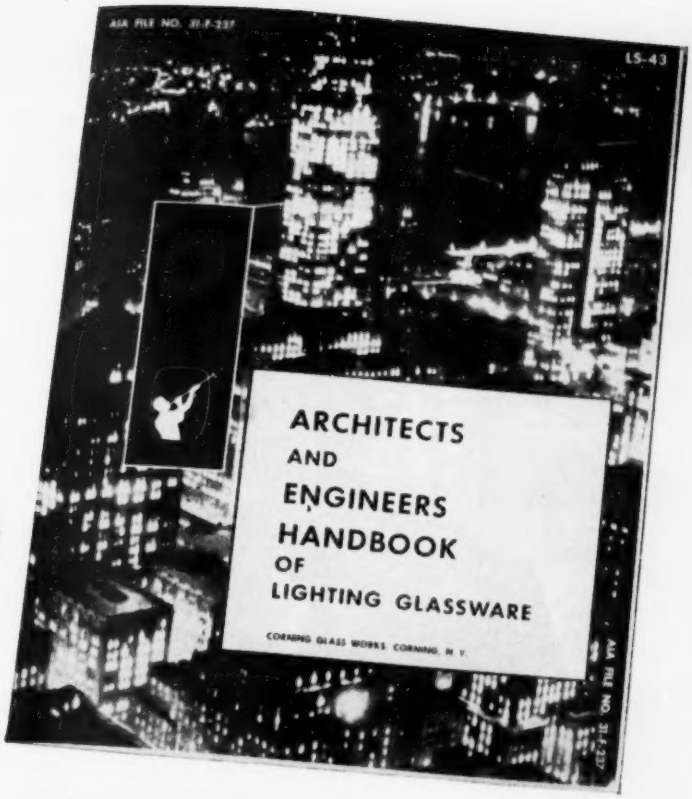

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It will take only a moment to write for this handbook and it will save lots of time whenever you are planning a lighting job. Write for it today.

Table of Contents:

Lighting Glassware Basic Types
Lighting with Large Area Luminous Elements
Lighting with Fluorescent Troffers
Lighting with Surface-Mounted and Suspended Luminaires
Product Information Table, Fluorescent Lighting Glassware
Lighting with Incandescent Lensed Fixtures
Product Information Table, Incandescent Lighting Glassware
Calculation Section

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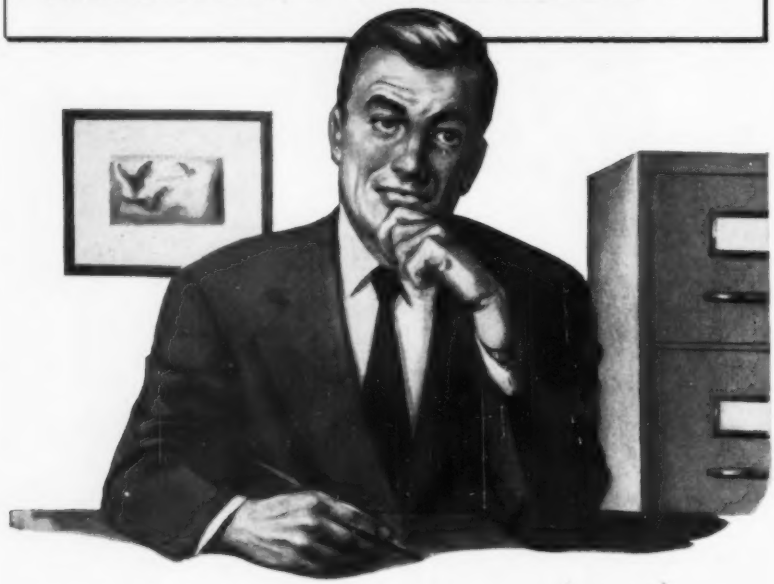

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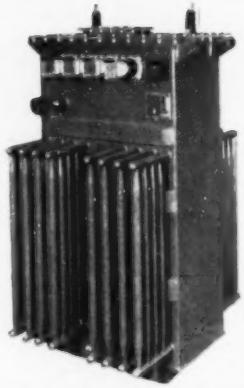

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building motors with unbalanced air gap. They all try to get as smooth as possible a distribution of the flux in the air gap.

If you make the lower half air gap longer, so as to have less pull, you will also obtain lower torque developed. Motor will be electrically unbalanced, efficiency will drop, and of course, less hp will be available at the shaft.

In this case my suggestion is: do not touch the air gap dimensions, use good lubricant, carry-on a proper lubricating schedule, check operating conditions.—J.R.S.

ANSWER TO E24—Modern practice discounts the theory expressed in the question, i.e. that the field will tend to naturally center the rotor in the stator and hence take the weight off the bearings. Good motor design together with good maintenance—lubrication will practically eliminate bearing wear. Good lubrication permits a film of oil between the shaft and the bearing, hence when running there should be no physical contact between the bearing and the shaft. Foreign matter, dust, grit, etc., will cause the bearing—and possibly the shaft also—to wear and naturally the wear will be on the lower side owing to the weight of the rotor pressing down—L.R.B.

Siren Tone

QUESTION F24—I want to cut down the speed of a motor driven siren to obtain a desired "sound." The tone wanted is just above starting speed. The siren is manufactured by W. S. Darley & Co., 7½ hp, current 4—220 volt 3 phase 60 C. 45 amps. 3500 RPM.

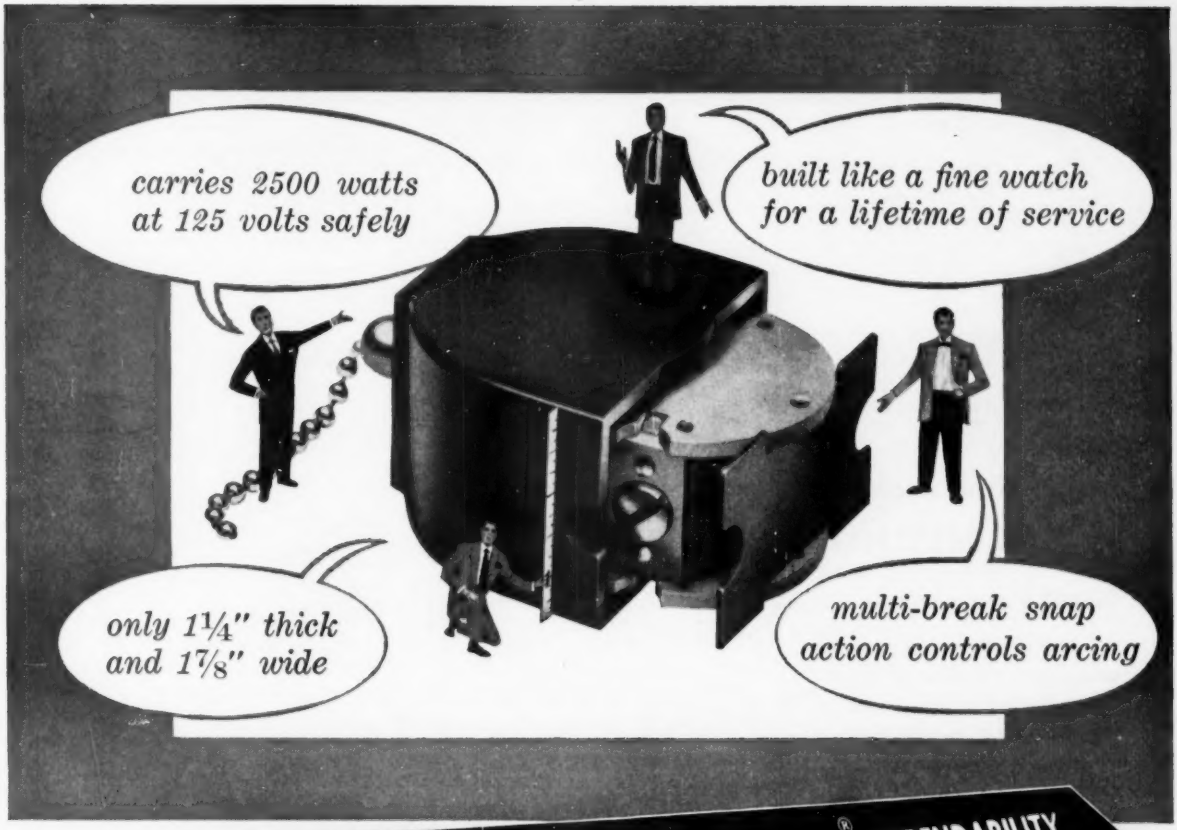
We have changed the blades without obtaining the desired sound.

What sort of controller would I need that can be safely used? Is there any other way of changing the sound waves, without cutting down the volume?

Reason for the above request—two houses of fire control are in close proximity and cannot distinguish the calls of their units.—A.S.S.

ANSWER TO F24—Having just installed a 5 hp 230 volt 3 phase, 60 cycle motor-driven siren manufactured by W. S. Darley & Co. and also desiring to obtain a different tone for identification, we used the following plan and found it very satisfactory.

Secure from W. S. Darley & Co. their Auto-Timer Control No. D-238 and use it to operate a 3 pole con-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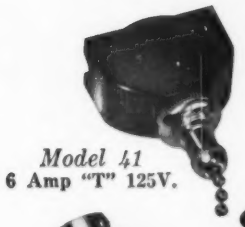

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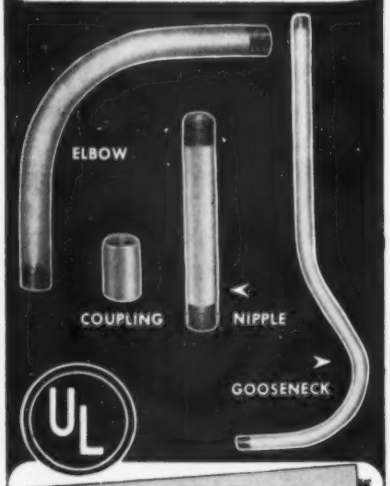

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tactor and wire auto-timer control to operate the coil of contactor, which in turn will operate the siren.

This No. D-238 control can be started either manually or electrically and will run from 1½ minutes to 2½ minutes (depending on predetermined setting) and will open and close the contactor circuit about 10 times in above setting and then automatically shut off.

These on-and-off periods will create an up-and-down-the-scale cycling which is very effective and distinctive.

Our installation is atop a 40 ft pole and is heard about three miles.

The timing disk furnished with the control is as above and we have changed ours to five on and five off in two minutes. Although we made our own dial for this installation, other dials to your specification can be supplied by W. S. Darley & Co. —G.H.M.

ANSWER TO F24—You have not indicated the exact speed desired and so only general statements can be made. It is suggested that the speed desired be checked by measuring the rpm at the desired "sound" by any suitable means, such as hand tachometer. An ordinary revolution counter would not be suitable as the speed is continually changing in the process of starting or stopping the motor. It is doubtful if any method of speed control would be effective and suitable on the motor. To get the desired speed it is suggested that the siren be altered to be belt driven instead of direct drive, as is usual. With the proper size pulleys the same motor or another motor can then be used to obtain the desired speed and the resulting "sound".—L.R.B.

ANSWER TO F24—Changing the tone of a motor driven siren by cutting down the speed is not satisfactory, due to the great decrease in volume of sound. There is however a very simple method of giving a motor driven siren a distinctive sound and this method is widely used. The method consists in giving the siren a "wailing" tone of a definite, constantly repeated pattern. Commercial equipment is available, but any clever electrician can readily assemble the necessary standard items. All that is required is a motor driven timer or flasher to interrupt the power supply to the siren driving motor, five to ten times per minute. The variation in speed of the siren will not be enough to greatly decrease its sound output, but it will have a very distinctive tone. Both of your sirens may be equipped to give a wailing tone, interrupting one say five times a minute and the other ten.—S.O.H.

Can you ANSWER these QUESTIONS?

QUESTION V24—Which is the best to use in lubricating ball bearings, an alemite type gun fitting or a grease cup. We have had quite a discussion over the merits of both types, but our mechanics seem to favor the grease cup because it will not pack a bearing too tight with grease.—L.W.F.

QUESTION W24 —What would cause a single phase condenser start electric motor to stop, when the starting switch closes, permitting the condenser to discharge in the winding, after you open the line switch? I would think that the discharging of the condenser would tend to make it continue to run till the condenser has been discharged.—R.E.G.

QUESTION X24—On a 3 phase 220 volt motor, I found that the nameplate read 1. amp. but lead A drew 1.15 amps —leads B and C drew .75 amps. In what leads should I connect the two heaters of the magnetic controller to protect the motor?—H.S.

QUESTION Y24 — An automatic washing machine installation consisting of 25 Laundromats suddenly started giving trouble, 8 or 9 of the motors overheated badly and some burned out. The motors are ½ hp. 120 volt, single phase and are protected against locked-rotor current only. The source of power is a bank of three 15 kva transformers, connected delta-star, 2400 volt, 120/208 volt, three phase, 4 wire. There are three primary fuses.

When the machines started smoking, all of them were unplugged, and a voltage check was made. Two phases showed the normal 120 volts, but the third phase showed only 55 volts. Presumably, it was this low voltage that caused the burnout of the starting winding on some of the motors. A check of the transformers showed that one primary fuse had blown. Upon replacing this fuse, everything was normal.

Three phase motors could be protected against this casualty by providing running protection in all three legs, but is there any way of similarly protecting single phase motors? Will someone give a vector diagram showing just what happens when one fuse of a delta-star bank blows? The standard textbooks are silent on this subject.—A.O.H.

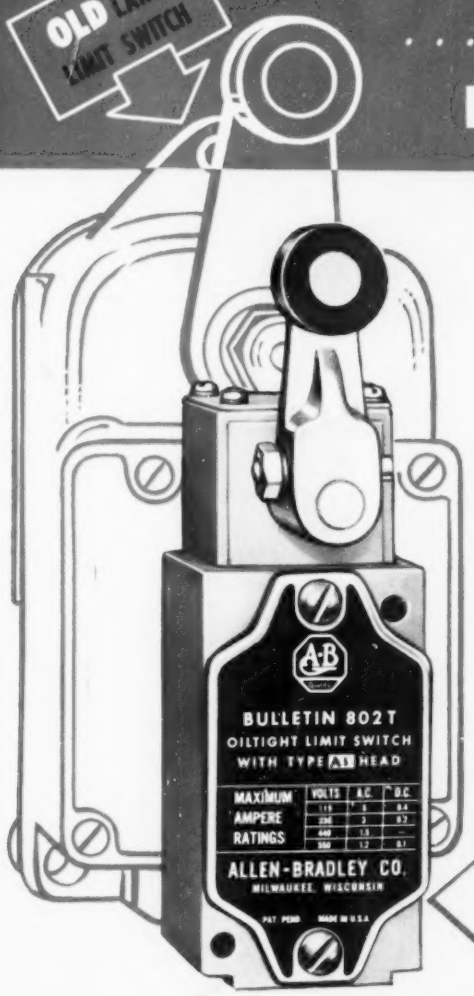
PLEASE SEND IN YOUR ANSWER BY DECEMBER 15

OVERSIZE

IS OFTEN A HANDICAP

. . . . . *especially in*

LIMIT SWITCHES



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A-B Quality

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9-53-MR

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A-B Quality

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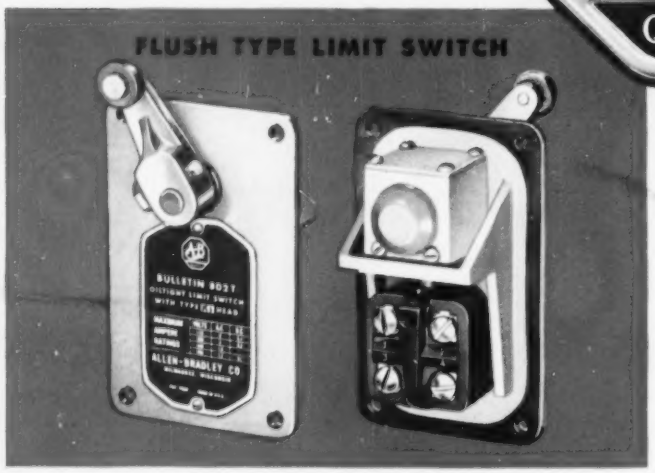

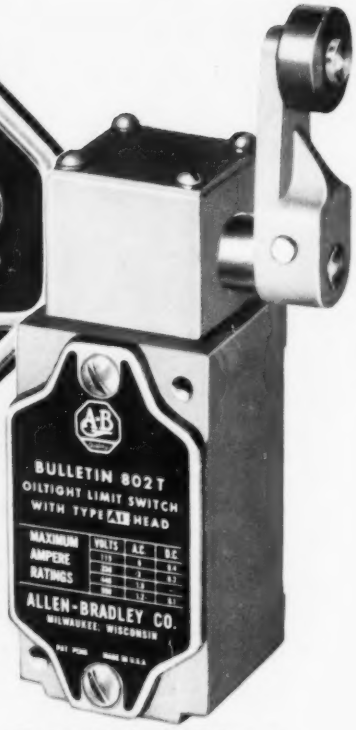

The operating head, with lever or push rod, may be set in 4 horizontal locations, each 90 degrees apart.

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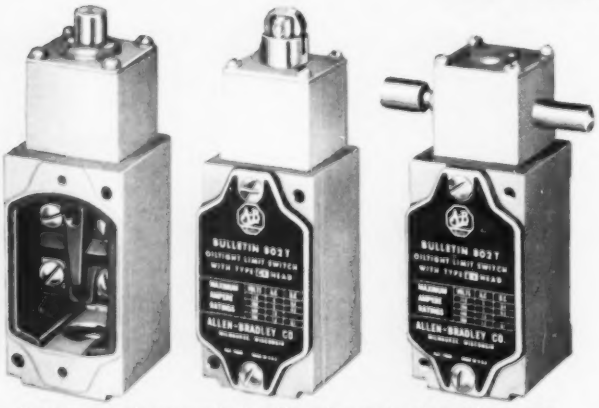

Operating heads are available with various push rods and levers. The switch is a single pole, snap acting unit, with one normally open and one normally closed contact, electrically separated. Most of these limit switches can be supplied for spring return or maintained contact operation.

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Bulletin 802T oiltight limit switches can be mounted from the front, using the two clearance holes shown above. For mounting from the back, two tapped holes are provided in opposite corners.

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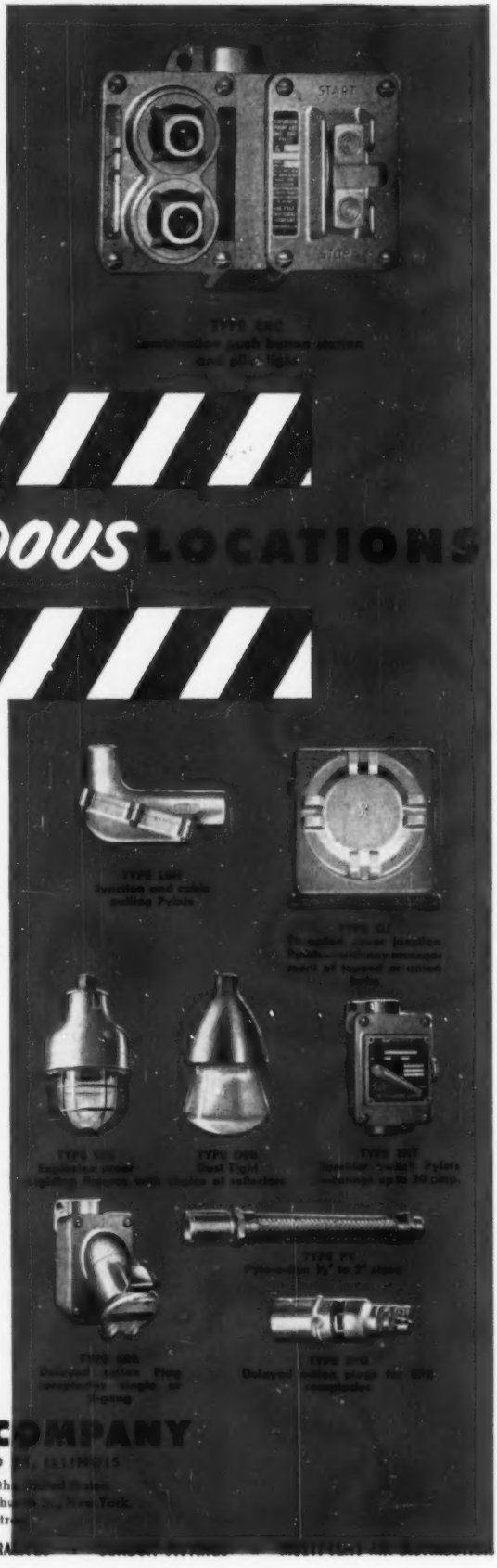

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Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Size of Service Board Neutral

Q. *Some time ago I specified a large number of panels for a new service and distribution for 4 wire, 3 phase, 120/208 volt. On a 2000 ampere service panel, I specified a 500 ampere neutral bus which figured out to be about twice what was actually needed from an unbalance on the 1 phase load. The panel manufacturer said that they'll have to install 50% of the phase buses for the neutral or 1000 ampere neutral bus. Where does the Code specify this? Seems like a waste of copper to me. I thought I was stretching a safety point by specifying 500 ampere bus.*—P.P.G.

A. I do not know of any Code provision which requires the neutral bus bar in a Service panel to be 50% of the size of a phase bus bar. Section 2304-a-4 tells us how to compute the size of the neutral service conductor. It reads as follows: "The neutral conductor shall have a current-carrying capacity in conformity with Section 2203-g, but shall not be smaller than the ungrounded conductors when they are No. 8 or smaller." Reference to Section 2203-g shows that the neutral conductor size is computed on the basis of the "maximum unbalanced load", and in the case of large services, a demand of 70% may be applied to that portion of the unbalanced load which is in excess of 200 amperes.

In the case you cite, I assume that the three phase, 4 wire, wye connected service is used principally for power at 208 volts, which does not concern the neutral. The neutral is only concerned with the 120 volt load. If, for example, the total 120 volt load is 500 amperes/phase, then the maximum unbalance would be 500 amperes and the neutral must have a current-carrying capacity of 500 subject to the 70% demand mentioned above. If the total 120 volt load was 300 amperes the same reasoning applies. In the absence of any Code provision covering the service panel, I believe this rule covering computation of the size of neutral service conductors also applies to the service equipment which are a part of the service. It appears inconsistent for us to require a neutral capacity in the equipment to be 50% of a phase capacity and then accept a neutral service conductor which could be in some cases as small as No. 8. If you have figured the neutral capacity in line with Section 2304-a-4 and 2203-g, we believe that your contention on this question is correct—B.A.McD.

Transformer Vault Ventilation

Q. *Does the Code provide a minimum size of ventilating opening for transformer vaults?—H.P.*

A. Section 4544 covers ventilation in general for transformer vaults. This American Standard de-

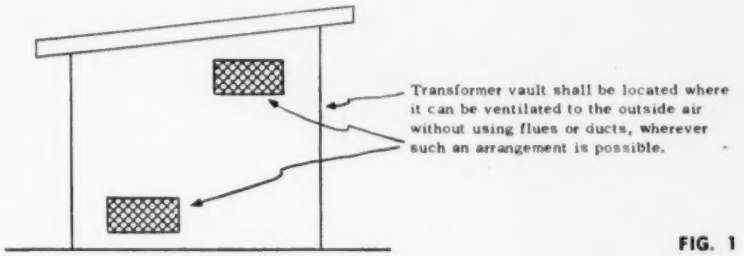

Transformer vault shall be located where it can be ventilated to the outside air without using flues or ducts, wherever such an arrangement is possible.

FIG. 1

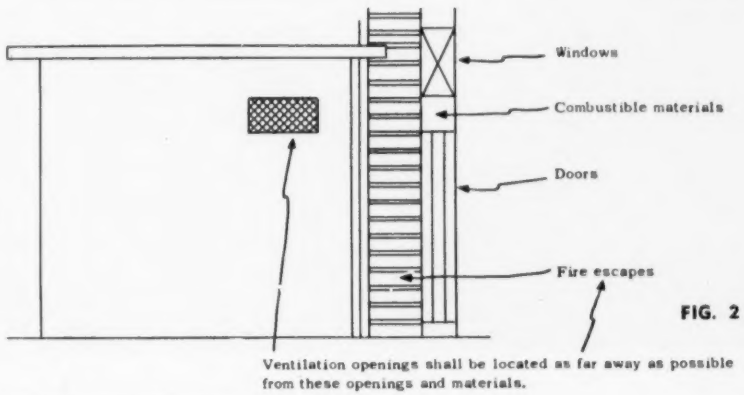

Windows
Combustible materials
Doors
Fire escapes
Ventilation openings shall be located as far away as possible from these openings and materials.

FIG. 2

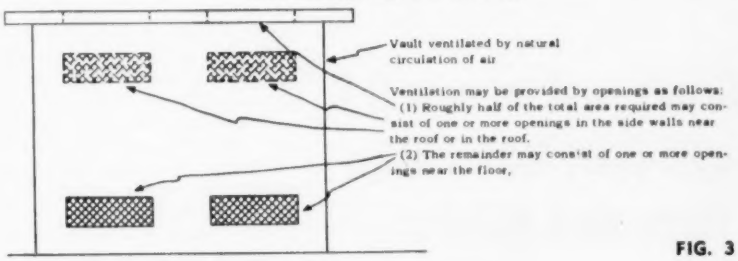

Vault ventilated by natural circulation of air
Ventilation may be provided by openings as follows:
(1) Roughly half of the total area required may consist of one or more openings in the side walls near the roof or in the roof.
(2) The remainder may consist of one or more openings near the floor.

FIG. 3

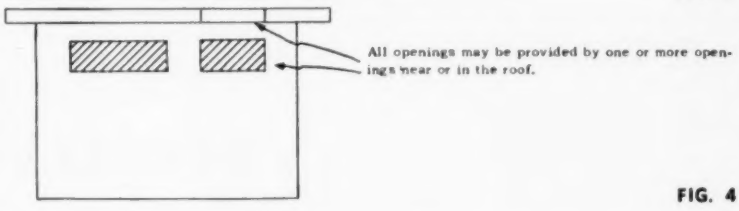
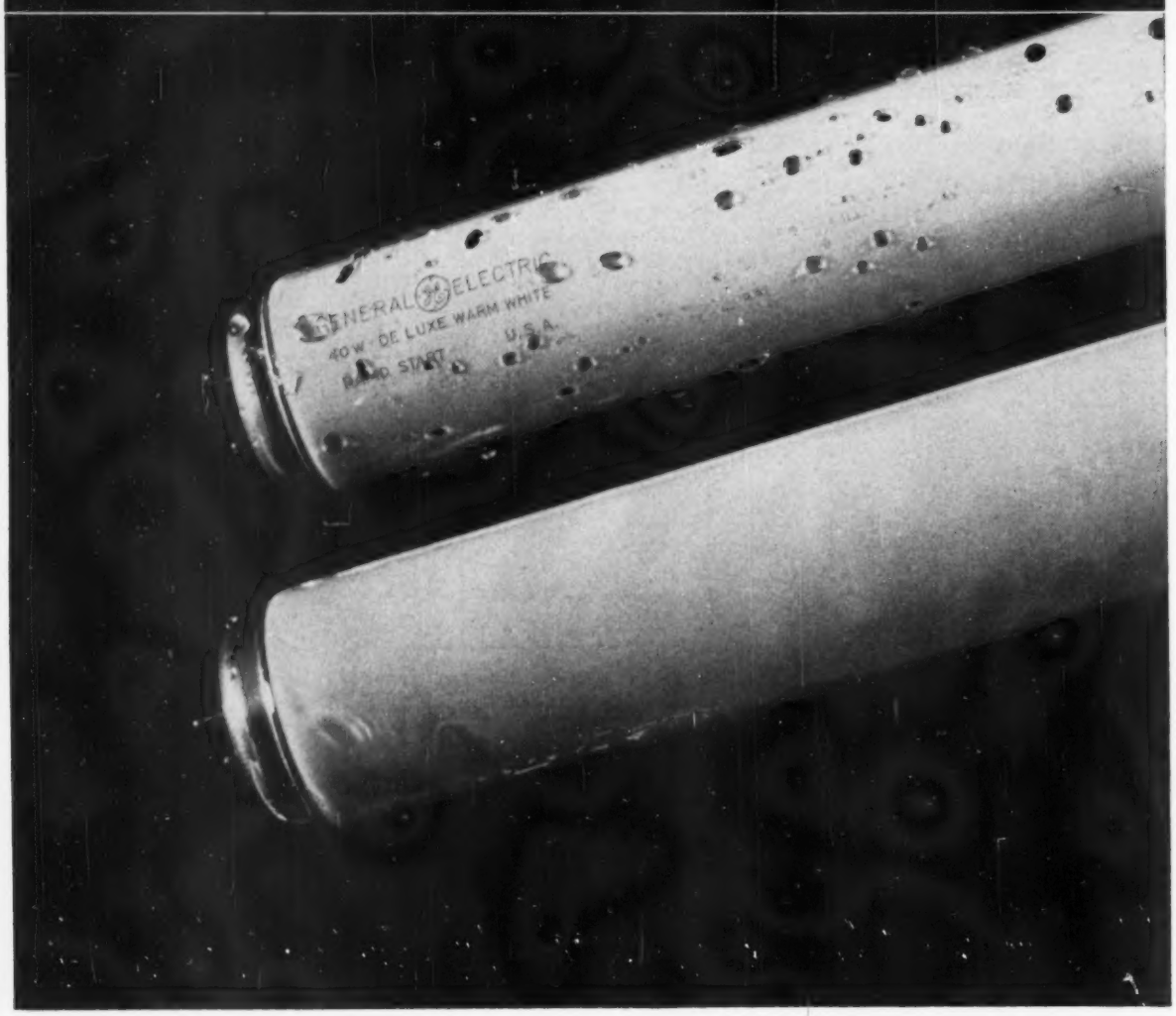


FIG. 4

You expect the best value from G-E fluorescent lamps



Silicone coat on new G-E Rapid Start lamps helps them start quicker

Moisture in the air can make a fluorescent lamp slow to start. The wet film that condenses on the lamp is a good enough conductor to detour some of the electricity needed for proper starting.

General Electric has tailored a "raincoat" that stops this. It's made of silicone and breaks up the wet film into tiny droplets, leaving dry areas that interrupt the electrical contact. Less current is stolen. Starting is quicker, surer.

We call the coating Dri-Film*. The photo above shows the difference it makes. Moisture breaks up into droplets on the Dri-Film* lamp, forms a smooth coating on the ordinary lamp.

You get Dri-Film* on G-E Rapid Start lamps. It's invisible, won't rub off, helps assure you all the light you pay for. Many leading manufacturers have designed lighting fixtures to use Rapid Start lamps and their special Rapid Start ballasts. You *expect* the best value from G-E fluorescent lamps. Here's another reason you can.

For more information, write General Electric, Department 166-EC-11, Nela Park, Cleveland 12, Ohio.

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You can put your confidence in—

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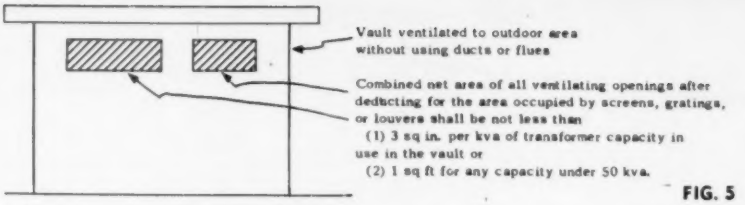
Vault ventilated to outdoor area without using ducts or flues
Combined net area of all ventilating openings after deducting for the area occupied by screens, gratings, or louvers shall be not less than
(1) 3 sq in. per kva of transformer capacity in use in the vault or
(2) 1 sq ft for any capacity under 50 kva.

FIG. 5

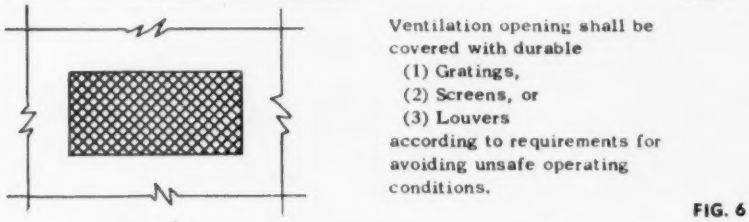
Ventilation opening shall be covered with durable
(1) Gratings,
(2) Screens, or
(3) Louvers
according to requirements for avoiding unsafe operating conditions.

FIG. 6

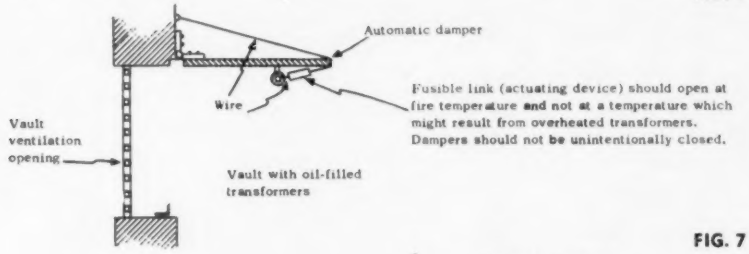
Automatic damper
Wire
Fusible link (actuating device) should open at fire temperature and not at a temperature which might result from overheated transformers. Dampers should not be unintentionally closed.
Vault ventilation opening
Vault with oil-filled transformers

FIG. 7

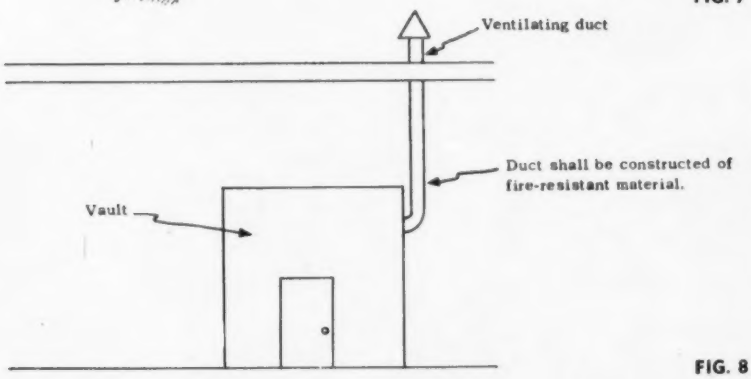

FIG. 8

velops quite thoroughly the means and methods for providing adequate ventilation to all vaults.

Fig. 1 shows the general requirements for the vault location as required by Section 4541.

Figs. 2, 3, 4, 5, 6, 7 and 8 show the requirements as set up by Section 4545 governing the ventilating openings for vaults.—B.Z.S.

Flexible Cord

Q. *We are rewiring a small factory in our town and are installing a busway over their production line. This factory has two products and they run approximately six months of each year on each product, making it necessary to reset their assembly line for each product. The engineering firm which they have hired has suggested the use of the busways with flexible cord assemblies to the various machines which must be moved in and out of this production line. Inasmuch as each one of these machines is rigidly fastened to the floor when it is in the production line, there is some question in my mind as to whether or not the Code will accept the use of a flexible cord as a connection between the busway and the machine. Do you feel that an inspector would be justified in refusing to accept such an installation?*—A.B.P.

A. It is true that a literal interpretation of Section 3646 of the 1951 Code would leave one in doubt as to whether or not it is possible to connect a machine of other than a portable type by means of a flexible cord to a busway. However, under this same section in the 1953 edition of the Code we will find permission to use a proper type of heavy duty cable to supply a fixed piece of equipment that must be moved when production schedule is changed. You will find the following statement under Section 3646 of the Code:

"Branches from busways shall be made with busways or with rigid or flexible metal conduit, electrical metallic tubing, surface metal raceways, armored cable, or with suitable cord assemblies approved for hard usage for portable equipment or for the connection of stationary equipment to facilitate their interchange."

So any piece of stationary equipment on a production line which must at some time or other be interchanged or moved about during changes in production may be connected by means of a suitable flexible cord to the overhead busway.—G.R.

Switching Inductive Loads

Q. *To switch fluorescent fixtures, we have been installing 125 volt 20 ampere toggle switches to handle not more than 11- 2 lamp fluorescent fixtures, each fixture drawing not more than .85 amps. Since some contractors install 10 amp, 125 volt switches to handle same load, we have been subject to criticism. My experience has been that 10 amp, 125 volt switches run hot and do not last long in service. I've always assumed that a fluorescent fixture load was inductive and have treated it as same. Can you give me some concrete information on same?*—P.P.G.

A. In the April 1953 issue of EC&M, we discussed this matter particularly from the standpoint of inductive loads. According to Section 3814-c, switches controlling inductive loads shall have an ampere rating twice the ampere rating of the load unless they are of a type approved as part of an assembly or for the purpose employed. It is my opinion that fluorescent fixtures comes under this heading even though the power factor has been corrected to a considerable degree. On page 68 of the Underwriters' Laboratories "Electrical Equipment List" for 1953, we note the following comment: "Alternating current ballasts for which high power factor is indicated can be considered as operating at 90% power factor under normal conditions. Where the power factor is actually indicated, the value given can be considered as the approximate power factor under normal operating conditions." It is important to note the words "normal conditions" since a ballast operating

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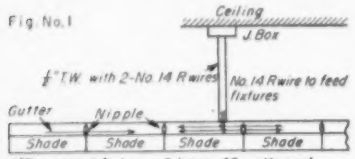
at 90% or 95% power factor under normal conditions would not do so under abnormal conditions.

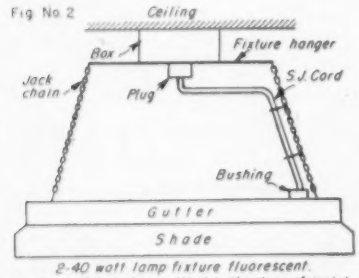
In the absence of any definite Code recognition of power factor correction on fluorescent lamps, it is my opinion, that the above mentioned rule, 3814-c applies and switches must be twice the ampere rating of such loads they control.—B.A.McD.

Fluorescent Fixtures

Q. *At a Code panel discussion, I heard a ruling which makes me wonder whether the proper interpretation was given. Is it Code-wise to run No. 14 R wire direct to channeled fluorescent fixtures that are designed for end to end mounting?*—P. P. G.



4' Fluorescent fixtures, 2 lamp, 40 watts each. Must a special high temperature be used.



2-40 watt lamp fixture fluorescent. Note: Is S.J. cord permitted in this type of installation? Or must some other type cord be used?

A. According to the Table in Section 3102, Type R insulation is approved for use where the maximum operating temperature does not exceed 140F. The same rule tells us that "No conductor shall be used under such conditions that its temperature, even when carrying current, will exceed the temperature specified in the table for the type of insulation involved". Section 4141 tells us that conductors used for wiring fixtures shall be so arranged that they will not be subjected to temperatures above those for which they were approved. Section 4122 says that the conductors in the outlet box feeding the fixture shall not be subjected to temperatures greater than that for which they are approved. Since the ballasts of fluorescent fixtures may develop dangerous temperatures under abnormal conditions and very often under normal conditions would subject the conductors involved to temperatures greater than 140F, it appears that if we are to satisfy the above mentioned Code requirements, insulation other than type R must be used. While it is difficult to specify a minimum type of insulation that would satisfy all of the fixture designs and conditions of use involved, experience indicates when branch circuit conductors are used to supply an end to end assembly as permitted by Section 4150, at least type RH conductors should be used. This point is recognized by U. L. in their listing of surface raceways, page 312 to 314 which shows that when such raceways are used with fluorescent lamps, and ballasts mounted inside the raceway that a type RH wire must be used and in some cases the current in each conductor is limited to 10 amps. (See page 314.)

In answer to your question concerning S J Cord, which is classed as a junior hard service cord with rubber insulation and a rubber outer covering, section 4125 recognizes the use shown in your illustration provided the insulation would not be subjected to temperatures in excess of 140F. In my opinion, the application shown primarily concerns the connection of a fixture to the outlet and not the wiring of the fixture.—B. A. McD.

Type USE Conductors

Q. *While making a roughed in inspection on a dwelling under construction, the well drillers were installing a submersible type pump and much to my surprise they were connecting Type USE solid conductors to a flexible lead from the motor casing on this pump by means of solderless connectors over which they intended to apply ordinary tape. I advised them that I would refuse to accept such a splice and yet upon my return to the office I am unable to find anything in the Code which actually covers such an installation. Can you advise me as to the action I should take regarding such an installation as I also have some question in my mind as to whether or not I should accept the solid conductors as I feel a flexible Type S cord would be preferable for the operation of this type of an appliance?*—T.H.P.

A. The use of the submersible type of pump in small 4-inch or larger well casings is rather new and apparently the National Electrical Code Committee have not received sufficient requests from the field to justify in their findings, any inclusion in the present edition of the Code, specific rules governing such installations. However, I agree that the use of ordinary tape for the insulation of a splice below water within a well casing should not be accepted and that where such splices are necessary, only a water-tight type of splice box should be accepted. In view of the probability of the pump having to be removed from the casing, I believe a flexible conductor would be preferable to solid Type USE conductors unless the solid conductors were firmly attached by some type of a clamp to the discharge pipe of the pump at least at 4½-foot intervals.—G.R.

Electrical Metallic Tubing Connector

Q. *Can the "indent" types of connector be set in concrete?*—J.J.

A. Section 3488 permits the connector to be buried in concrete, etc., if

a. the connector is made up tight, and

b. the conductor is of a type which will prevent water from entering the raceway.

So the answer to the question would be contingent on whether or not the type of connector used satisfied these two conditions, especially the second one. The manufacturer's recommendations and the UL listing would have to answer this for any one specific type of connector.—B.Z.S.

Circuit Grounding

Q. *Why does a three phase, 440 volt circuit continue to operate without blowing fuses or opening relays with one leg showing zero potential to ground? It does not make sense to me.*—R.D.O.

A. As long as only one phase or wire of any circuit is grounded (intentionally or accidentally) the electrical integrity of the circuit is not impaired. Many utility companies actually will ground a corner of a 440 volt, three phase system. This definitely establishes the potential above ground for the system, and of course offers protection to the other two phases in the event either of them ground out.

If either of the other two legs ground out there would be a completed "short circuit" since two wires would be connected to ground. As long as only one phase or wire of any complete system is grounded the circuit will operate without blowing fuses or opening relays.—B.Z.S.

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Duplex

No. 5231
Single Pole Switch

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3 Way Switch

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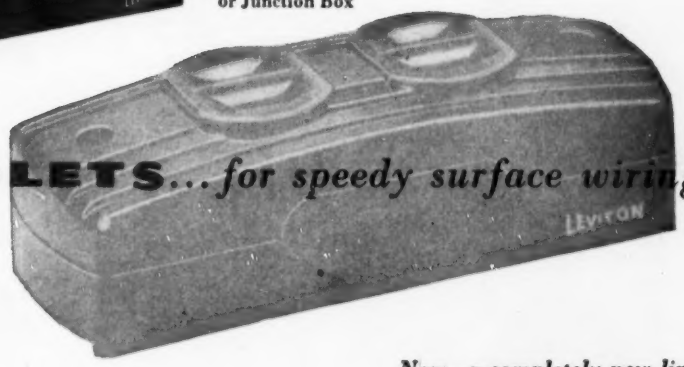
or Junction Box



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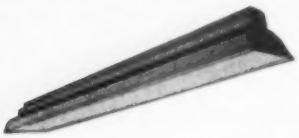

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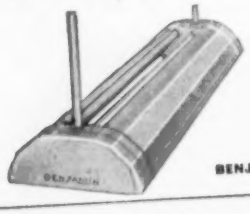

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A rugged lighting unit for steel mills, foundries, sheet metal works, and other locations where the lighting units must be guarded against damage from rough handling, flying metal particles, severe mechanical strain or unfavorable atmospheric conditions.

BENJAMIN "Steelite" *described in Manual #3*

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This unit inexpensively matches a variety of general seeing tasks; also for stairways, materials handling areas, etc. Exclusive "Turnlox" detachable reflector cuts time required for cleaning and relamping.

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☐ **5.** lighting for **BINS and SHELVES**

A reflector of unique design, combining uniformity of illumination with careful shielding. Uniformly lights top-to-bottom of shelves, bin tiers in stock rooms, tool cribs and book stacks. Especially adapted for the low mounting heights and narrow aisles of such locations.

BENJAMIN "Stock-Bin-Lite" Reflector *described in Manual #5*

☐ **6.** safe lighting for **HAZARDOUS LOCATIONS**

For locations listed by U.L. as Class 1 Groups C and D. Recommended for areas where explosive atmospheres or inflammable dust is found. Available in a choice of four reflectors and a variety of mountings. Especially constructed to withstand the tremendous pressure of internal lamp explosion.

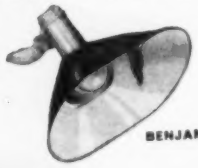
BENJAMIN "Explosion-Proof" Units *described in Manual #6*

☐ **7.** approved lighting for **HUMID LOCATIONS**

Listed "Vapor-Tight" by U.L. Suitable for use in locations exposed to moisture or non-combustible dust, corrosive fumes, vapors, dust and smoke. Rugged construction, unbroken surface of Porcelain Enamel and heavy-gauge steel assure long life without breakdown or frequent servicing.

BENJAMIN "Vapor-Tight" Units *described in Manual #7*

☐ **8.** proper floodlighting for **OUTDOOR INDUSTRIAL AREAS**



The ideal all-weather unit for industrial recreational areas, ball fields, pools, etc. Highest quality outdoor illumination due to combination of large diffusing Porcelain-Enameled Steel Reflector with inner aluminum reflector.

BENJAMIN "Play Area" Floodlight *described in Manual #8*

B-215R

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Modern Lighting

MERCHANDISE and sales counters are highlighted by louvered panels, coves and adjustable spots while general illumination is provided by standard commercial fixtures suspended above the rubber-tiled flooring of this progressive showroom.

Canopy Provides Accent for Showroom Display

The judicious use of light provides a sales-producing accent for equipment on display at the Keystone Plumbing showroom in Pittsburgh, Pennsylvania, where louvered panels, adjustable spots, cove treatments and conventional fluorescent fixtures are in use.

For example, a central island counter is surmounted by a lighting canopy combining a louverall section measuring 6-by-12-feet, and four swiveling spotlight units, two on either end of the assembly. Lamps used in the spotlight units are 150-watt incandescents, while 40-watt white fluorescent lamps (16 in number) are mounted in single-lamp Day-Brite channels above the 2-by-2-by-2-inch cellular canopy. With lamps approximately on 1-foot centers 1-foot above the louverall panel, and with the panel suspended only 6 feet above the counter top, the intensity of light provided solely by fluorescent lamps is 75 footcandles. Highlighted areas illuminated by the spotlights have well over 200-fc. The lighting load for this one area amounts to 1.24-kw.

Around the large showroom are displays of model kitchens, bath and utility rooms, each arranged on a stepped platform and illuminated by continuous double rows of fluorescent lamps mounted end-to-end with ends of the two rows staggered to minimize dark spots. The remaining area of the room is generally lighted by egg-crate-louvered commercial fixtures and adjustable spots which are directed to the many free-standing samples on the open floor.

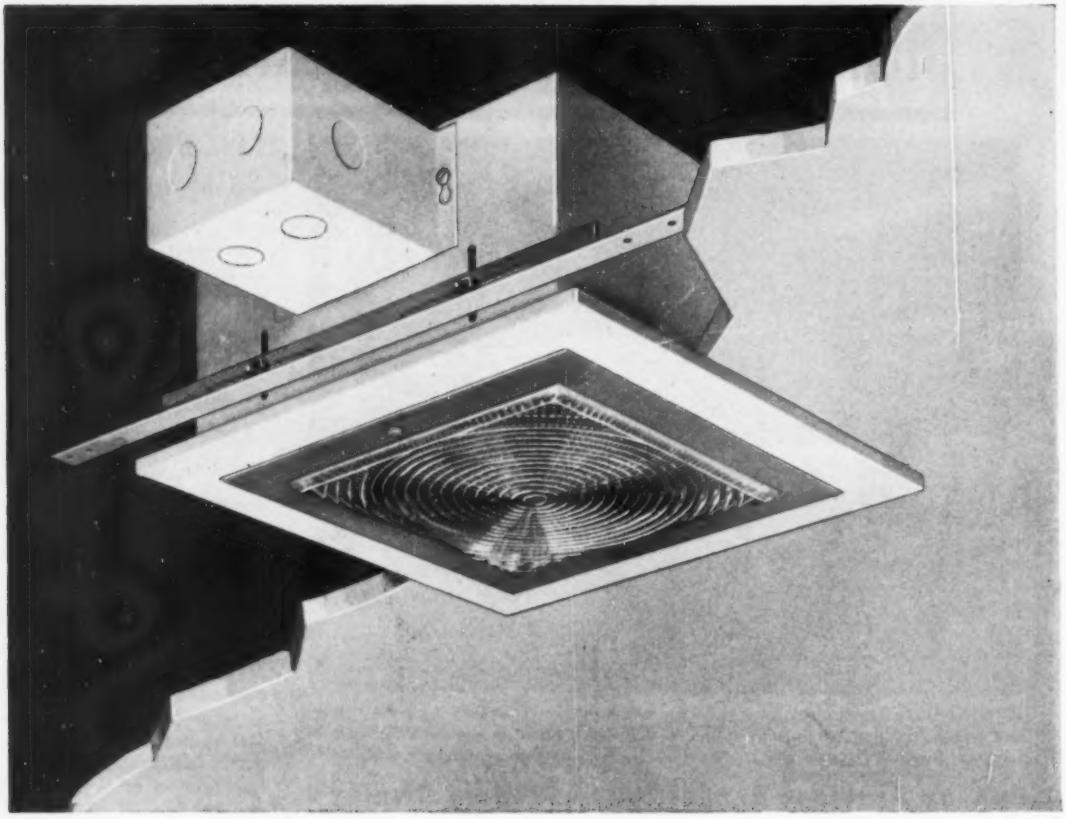
Floodlights for Auto Sales and Parking

Ofgant-Jackson Chevrolet, Inc., in Roxbury, Massachusetts, operates a giant outdoor lot which serves the dual purpose of displaying used cars for sale and providing ample parking space for shoppers in the neighborhood. And, to provide illumination in this two-purpose area, there are two distinct levels of lighting provided by high-mounted floodlight units, 10 footcandles being provided in the sales area and between 3 and 4 footcandles for general parking at time of installation.

The lighting units used are medium beam Steber fixtures containing 1500-watt lamps in diffuse Alzak aluminum reflectors. Mounting heights are approximately 25 feet above ground. In all, there are 52 units, resulting in a connected lighting load of 78-kw. Grouping of fixtures, spacing of poles and aiming of reflectors has produced even distribution, while the high mounting of units minimizes the glare factor.

The lighting plan was laid out by W. C. Brown of the Boston Edison Company's lighting consulting division, while the J. J. Reddington Electric Service Company of Roxbury made the installation.

MULTIPLE MOUNTING of medium beam floodlights on 25-foot poles provides even distribution of illumination for this sales-parking lot. Alzak reflectors and 1500-watt lamps result in ample intensities.



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5. Extra long type AF leads factory wired to porcelain socket.

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6. Attach to any standard construction:
A. Nail holes for 14" and 16" joist spacings.
B. Bend straps at 90° for joist side attachment.
C. Nail or screw to top of plywood, wood lath, etc.
D. Wire twist through nail hole secures to metal lath.

7. Vertical Slotted Holes provide adjustment for any ceiling thickness from ½" to 2".

8. Captive Floating Nuts slide in Horizontal Slots to provide lateral adjustment between joists.

9. Tighten Mounting Screws from inside to lock Insert Box rigidly in adjusted position.

REFLECTOR AND AMCOLENS COMBINE FOR MAXIMUM LIGHTING PERFORMANCE

10. Specular Aluminum Surface is Figurated for smooth spread distribution (no hot spots).

11. Firmly attached with one thumb nut. Seals off ceiling trim to eliminate light leakage.

HINGED DOOR SAFETY, CONVENIENCE, AND PERMANENCE

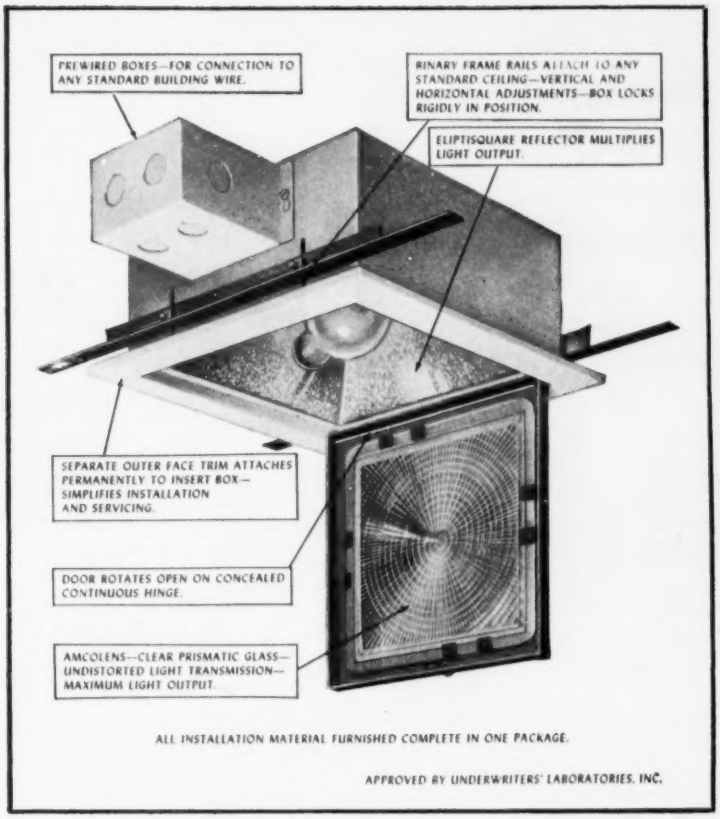
12. Door rotates open on Concealed Continuous Hinge. Nothing to drop or get out of order.

13. Single Retained Thumb Screw for Positive Door Closure. No tools required—one-hand relamping.

14. Captive Floating Nut automatically aligns with and protects screw threads.

15. Separate Outer Face Trim attaches permanently to insert box after installation.
No damage to Face Trim during installation.
No marring of ceiling finish in service.

16. Insert Box serves for plaster ground.
No plaster frame required.


PREWIRED BOXES—FOR CONNECTION TO ANY STANDARD BUILDING WIRE.
BINARY FRAME RAILS ATTACH TO ANY STANDARD CEILING—VERTICAL AND HORIZONTAL ADJUSTMENTS—BOX LOCKS RIGIDLY IN POSITION.
ELIPTISQUARE REFLECTOR MULTIPLIES LIGHT OUTPUT.
SEPARATE OUTER FACE TRIM ATTACHES PERMANENTLY TO INSERT BOX—SIMPLIFIES INSTALLATION AND SERVICING.
DOOR ROTATES OPEN ON CONCEALED CONTINUOUS HINGE.
AMCOLENS—CLEAR PRISMATIC GLASS—UNDISTORTED LIGHT TRANSMISSION—MAXIMUM LIGHT OUTPUT.
ALL INSTALLATION MATERIAL FURNISHED COMPLETE IN ONE PACKAGE.
APPROVED BY UNDERWRITERS' LABORATORIES, INC.

Order ELIPTISQUARE units from your ART METAL authorized distributors...see how your installation time and costs are cut.

You Time, Money !

You can Install ART METAL ELIPTISQUARE easier and quicker

Regardless of ceiling construction, you can install ART METAL ELIPTISQUARE shallow recessed boxes with less trouble and in less time! You'll save money on every job.

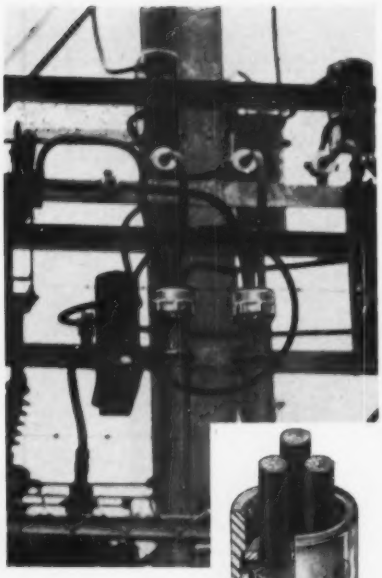
ELIPTISQUARE offers 16 points of performance superiority and time-saving installation advantages.

As with all ART METAL incandescent lighting equipment, you get engineered construction and superior lighting performance.

THE **ART METAL** COMPANY

CLEVELAND 3, OHIO

Manufacturers of Engineered Incandescent Lighting



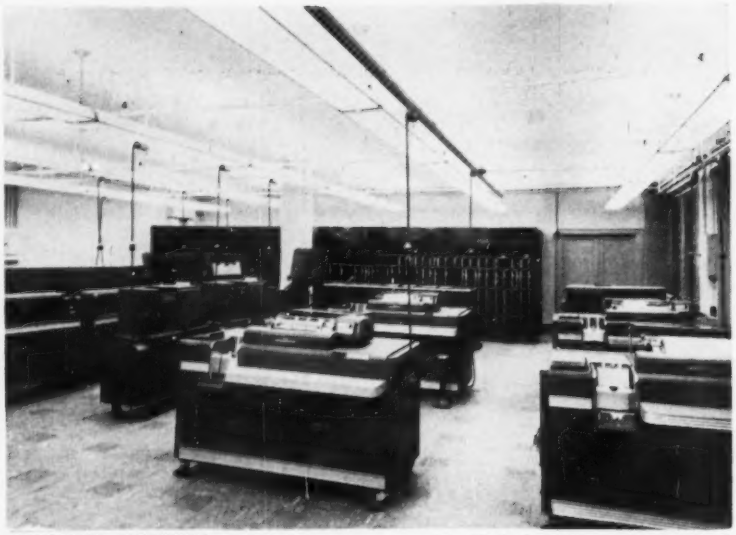
Support seals installed on breaker and regulator structure

Cable Supports and Seals

The Adalet "Wedgelock" Supports in the above illustration are engineered for double duty . . . they support the cable, and are compound filled for weather-tight terminals. "Sali" wedges are tapered for locked grip. Easy to install.

Write for Bulletin G covering the complete "Wedgelock" series

THE ADALET MANUFACTURING CO.
CLEVELAND 11, OHIO



LOUVERED FIXTURES on 7½-foot centers provide 62-fc for this arrangement of business machines. Trolley duct installation provides flexible power pattern. Light green in various tones is used as the color motif for walls and floor.

Even Distribution for Office Machines

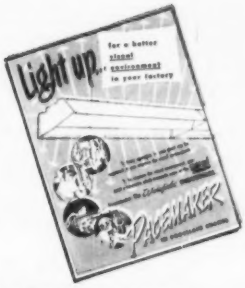
The International Business Machine Corporation's office in Boston, Massachusetts, obtains an average of 62 footcandles of illumination through an installation of 2-lamp 75-watt louvered commercial fixtures, mounted end-to-end in continuous rows on 7½-foot centers at a mounting height of 9 feet above the floor.

The Gill units contain 45-degree shielding for the standard white fluorescent lamps. Units are pendant suspended 2 feet beneath an acoustical tile ceiling. The interior is light green in two tones, while the flooring is likewise light green in a mottled pattern.

Power for business machines is distributed by trolley duct runs mounted adjacent to each line of lighting fixtures, with mobile take-off trolleys, twist-lock connecting plugs and flexible rubber-covered drop cords making the actual delivery. The Gaston Electric Company installed fixtures and duct-work alike, while the lighting system was designed by Paul V. Chandler of the Boston Edison Company.

SHOWROOM LIGHTING for attraction, atmosphere and appeal is clearly demonstrated by a recent installation of a luminous ceiling at the Chamberlin Chevrolet Inc. agency, Long Island, N. Y. Sylvania fluorescent fixtures are mounted in an 18-inch cavity lined with sheet insulation and painted white. The complete ceiling of the showroom is suspended below the cavity and consists of vinyl plastic panels. Deluxe cool white fluorescent lamps are mounted in the fixtures in the cavity. The lighting intensity at the work level is 72 footcandles.

Here's an industrial luminaire that has nearly everything



Would you like an illustrated 4-page folder? Just write to The F. W. Wakefield Brass Company, Vermilion, Ohio.

It has a light distribution of about 25% up and 75% down. That's basic for comfortable seeing. Offices have been away ahead of factories on this score.

It has all major reflecting surfaces finished in porcelain enamel. That means long life, easy cleaning, no discoloring.

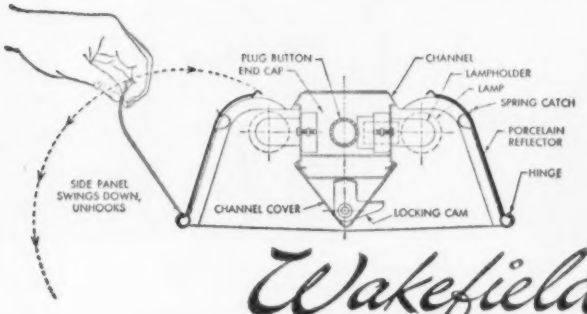
It has side panels that unhook and hinge downward. That means easy, quick, safe cleaning. As for lamps, you can replace them *without* unhinging the side panels.

It has channels, channel covers, end panels and side panels of heavy gauge steel. Really rugged.

It has ETL approved, brick type ballasts that deliver full rated lamp watts. Very good feature. Means fewer luminaires per square foot.

It has a simple chain suspension that permits hanging at almost any distance below the ceiling. Singly or in continuous runs.

It has been designed to use either pre-heat Rapid Start (40W) or Slimline lamps. Take your choice in 4', 5' or 8' lengths.



Now do you see why we say the Pacemaker has nearly everything? To be honest, we think it does have everything a modern industrial luminaire ought to have, but a little understatement never hurts. At that, there is one thing it doesn't have. It doesn't have a sky-high price tag.

Wakefield Over-ALL Lighting

New Floodlamps Solve Tough Problems Indoors and Outdoors

MAXIMUM LIGHT OUTPUT • WIDE BEAM

200 to 1000 Watts
St'd. or High Voltage

For High or Low Bays

High light output maintained throughout lamp life. Only simple socket required. No reflectors to clean.

For Wet or Dusty Locations

Hard glass withstands moisture and sudden temperature changes. Inside silver reflector not affected by dirt and corrosive fumes.

For Outdoor Lighting

Permits use of low-cost weatherproof housing, reducing cost, size, and weight of installation. Easy to maintain.

Send for Technical Bulletin 80

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Reflector Weatherproof
FLOODLAMPS

RADIANT LAMP CORPORATION
300 Jelliff Avenue Newark 8, N. J.

Manufacturers of Lamps for
PROJECTION • FLOODLIGHT • SPOTLIGHT • MOTION PICTURE PRODUCTION
AERONAUTICAL • SPORTS LIGHTING AND GENERAL SERVICE • RECTIFIER BULBS

50 FOOTCANDLES of maintained illumination is provided on desk surfaces by continuous rows of 2-lamp louvered and luminous-sided fixtures pendant-suspended beneath a natural white acoustical ceiling on 8-foot centers.

Office Relighting Promotes Efficiency

Modern, attractive, up-to-date working conditions conducive for efficiency and high employee morale are obtained by the Massachusetts Bonding and Insurance Company, Boston, where 50 footcandles of maintained illumination are provided by standard cool white fluorescent lamps contained in louvered and luminous-sided commercial fixtures. Units are made by Gill, having 45 degree louver shielding in both directions, while side panels are translucent glass. Lamps are General Electric rapid start T-12s, two 40-watt lamps being contained in each section.

In order to clear the deep structural beams that protrude beneath the acoustical tiling of the ceiling, fixtures were suspended on 18-inch hangers, and an 8-foot center-to-center distance was established for the continuous rows. In all, there are 270 fixtures in this 8000-sq. ft. office area, representing a 27-kw connected lighting load, and slightly over 3 watts per sq. ft.

Designed by C. A. Russell of the Boston Edison Company's Commercial Lighting Division, the installation was made by company electricians under the direction of W. N. Eichorn. The color scheme in the office is green; three shades being used for upper, center and lower walls. The floor tiling is also mottled green in a checkerboard pattern, while the sound-absorbing ceiling is natural white.

CONTESTANTS in IES "My Most Interesting Lighting Job" contest at 45th annual IES National Technical Conference are briefed by Lee E. Tayler, Detroit Edison Co., contest chairman, before final runoff. Contestants are (seated, l. to r.): Merrill Humber, San Francisco; Benoit Doucet, Canada; Walter A. Toly, Spokane, Wash.; (standing, l. to r.): R. R. Duncan, Jr., New Bedford, Mass.; Mario G. Zervigon, New Orleans; Nick Stuffer, Cleveland; Henry Koether, Milwaukee; and L. E. Spears, New Castle, Pa.

IN PLANT SPACE

AN ARROW-HART MOTOR CONTROL CENTER

CAN SAVE over 50% MORE

THAN ANY OTHER TYPE

For Example: **BOTH OF THESE CONTROL CENTERS HOUSE 12 SIZE-2 REVERSING COMBINATION STARTERS**

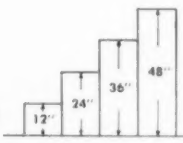
ARROW AH HART

MOTOR CONTROL CENTER

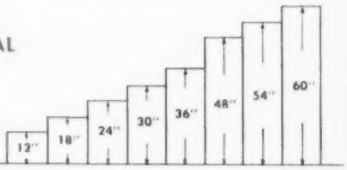
Because:

TO ACCOMMODATE ANY NON-REVERSING COMBINATION STARTER FROM SIZE 1 TO SIZE 5 OR ANY 2-SPEED OR REVERSING COMBINATION STARTER FROM SIZE 1 TO SIZE 3 . . .

AH CONTROL CENTERS REQUIRE JUST THESE **4** STANDARD UNIT COMPARTMENTS



. . . WHILE CONVENTIONAL CONTROL CENTERS REQUIRE THESE **8** STANDARD COMPARTMENTS



Unequalled Flexibility

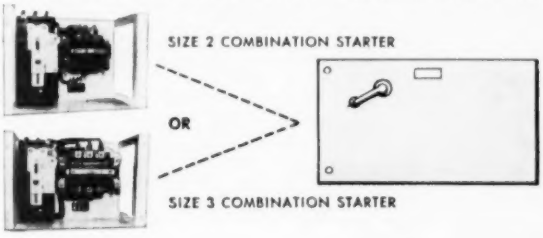
— Because Arrow-Hart Control Centers Expand Quickly, Easily To Meet Plant Growth . . .

- All compartments are in multiples of 12" high, no odd sizes or waste space.
- Vacant compartments can be provided in laying out the initial Control Center installation.
- Any number of basic sections can be added as required; each accommodates up to six 12" high compartments.
- If machinery groups (or the entire plant) are moved to a new building, the Control Center can be moved without disturbing the internal wiring.
- Thanks to the much smaller size of exclusive A-H "Right Angle" Design Starters, ratings can be increased up to and including 30 H.P. without increasing the size of the compartment or the Control Center. Simply replace the original starter with a larger unit; for example . . .

Any One of These AH COMBINATION STARTERS

REVERSING and 2-SPEED SIZES 1 and 2	NON-REVERSING SIZES 1, 2 and 3

CAN BE HOUSED IN THIS SINGLE 12" HIGH COMPARTMENT SIZE

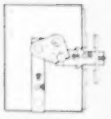


TURN THE PAGE FOR ADDITIONAL INFORMATION

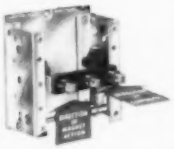
THE ARROW AH HART MOTOR CONTROL CENTER

Special Features

EXCLUSIVE ARROW-HART "RIGHT ANGLE" STARTER DESIGN



The remarkable space savings possible with Arrow-Hart Control Centers are, in turn, made possible largely through the much smaller size and lighter weight of A-H "Right Angle" Starter Units. Basic in this revolutionary design is a completely different type of operating mechanism. Working through a bell crank lever, a much smaller magnet is able to outperform the old fashioned, direct-acting type. This first real advance in motor control design in over 20 years is now thoroughly tested, approved and acclaimed throughout industry. Here are some of its important benefits —



- GREATLY REDUCED SIZE and WEIGHT
- STRAIGHT-THRU FRONT WIRING
- ALL PARTS EASILY ACCESSIBLE FROM FRONT
- VERTICAL CONTACT POSITION PREVENTS ACCUMULATION OF BREAKDOWN MATERIAL
- IMPROVED PERFORMANCE and DEPENDABILITY
- POSITIVE UNDERVOLTAGE RELEASE
- POSITIVE CONTACT ALIGNMENT
- SUPERIOR ARC SUPPRESSION with completely isolated individual arcing chambers

A SAFE OPERATING HANDLE

The newly re-designed external handle mechanism assures safe operation at all times. The door cannot be opened unless the handle is turned to "OPEN" with the circuit breaker or disconnect switch in the safe "OFF" position.

To assure safe maintenance, the handle can be locked only in the "OFF" position, and provision is made for 3 padlocks. The circuit breaker is equipped with a truly self-aligning mechanism that aligns the handle with the actual position of the breaker when the door is closed.

TWO TYPES OF STARTER CONNECTION TO THE VERTICAL BUS

THE PERMANENT TYPE . . . utilizes wires from the Starter Units bolted to the vertical bus. Mounting depth is the same for both front mounting only and for back-to-back mounting.

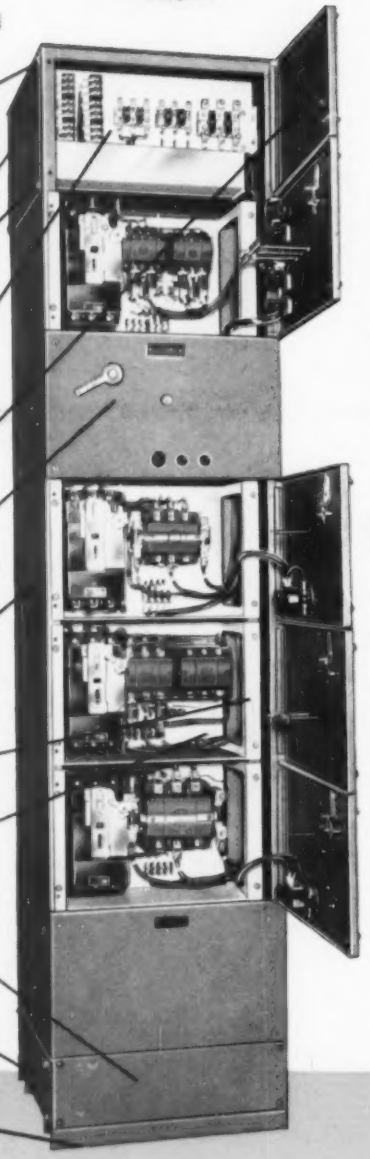
THE SELF-LOCKING "STAB" TYPE . . . utilizes Starter Units equipped with "Stabs" that "plug in" to the vertical bus. Starter Unit can be instantly and safely installed or removed while the bus is "hot" without shutting down the Control Center. Arrow-Hart Stabs provided with free-floating, self-aligning clips assure fast, positive, "no hunt" connections.

3 TYPES OF CONSTRUCTION

NEMA A, B or C

If Type C is specified, all wiring, interwiring and sequencing required for the complete Motor Control Center is completed at the factory, and a Wiring Diagram of the entire multi-unit Center is provided.

CONSTRUCTION FEATURES


FRONT or BACK-TO-BACK MOUNTING IN THE SAME 20" SPACE
HORIZONTAL BUS 600 or 800 Amp. Capacity
REMOVABLE TOP AND SIDE PLATES
MASTER TERMINAL BOARD and HORIZONTAL WIRING TROUGH
PAN-SHAPED DOORS For Greater Rigidity
DUST TIGHT or WEATHER RESISTANT CONSTRUCTION ALSO AVAILABLE
VERTICAL BUS Flat for Permanent Connections, Rounded for Stab Type
CONVENIENT VERTICAL WIRING TROUGH
WHITE INTERIOR FINISH For Easy Visibility
REMOVABLE FRONT AND SIDE PLATES
WIRING SPACE IN BASE
REMOVABLE MOUNTING CHANNELS

No other MOTOR CONTROL CENTER *offers you*

- **SO MANY IMPORTANT FEATURES**
- **SUCH GREAT SAVINGS**
  In Plant Space — In Installation — In Maintenance
- **SO MANY ADVANTAGES**
  In Improved Performance — In Added Flexibility

Write Now FOR COMPLETE INFORMATION

Use handy coupon attached to send for your free copy of this Arrow-Hart Motor Control Center Bulletin.

INDUSTRIAL CONTROL DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO.
103 Hawthorn Street, Hartford 6, Conn.

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ARROW-HART

INDUSTRIAL CONTROL DIVISION

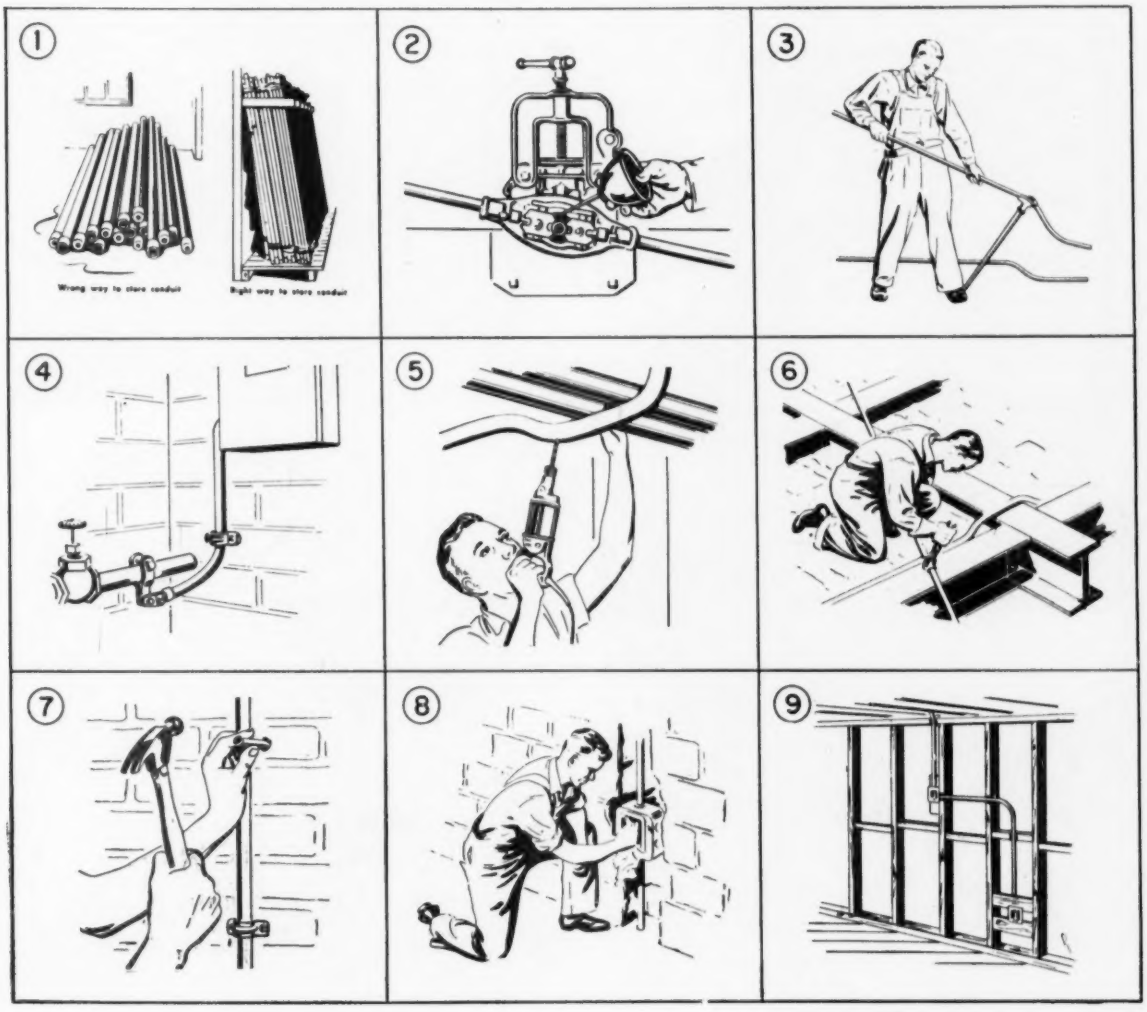
THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD 6, CONN., U.S.A.

OFFICES, SALES ENGINEERS AND WAREHOUSES IN: ATLANTA, BOSTON, BUFFALO, CHICAGO, CINCINNATI, CLEVELAND, DALLAS, DETROIT, HOUSTON, INDIANAPOLIS, KANSAS CITY, MO., LOS ANGELES, MILWAUKEE, MINNEAPOLIS, NEW YORK, PHILADELPHIA, PITTSBURGH, ST. LOUIS, SAN FRANCISCO, SYRACUSE. In Canada: ARROW-HART & HEGEMAN (CANADA) LTD., MT. DENNIS, TORONTO.

PRINTED IN U.S.A.

Data Sheet

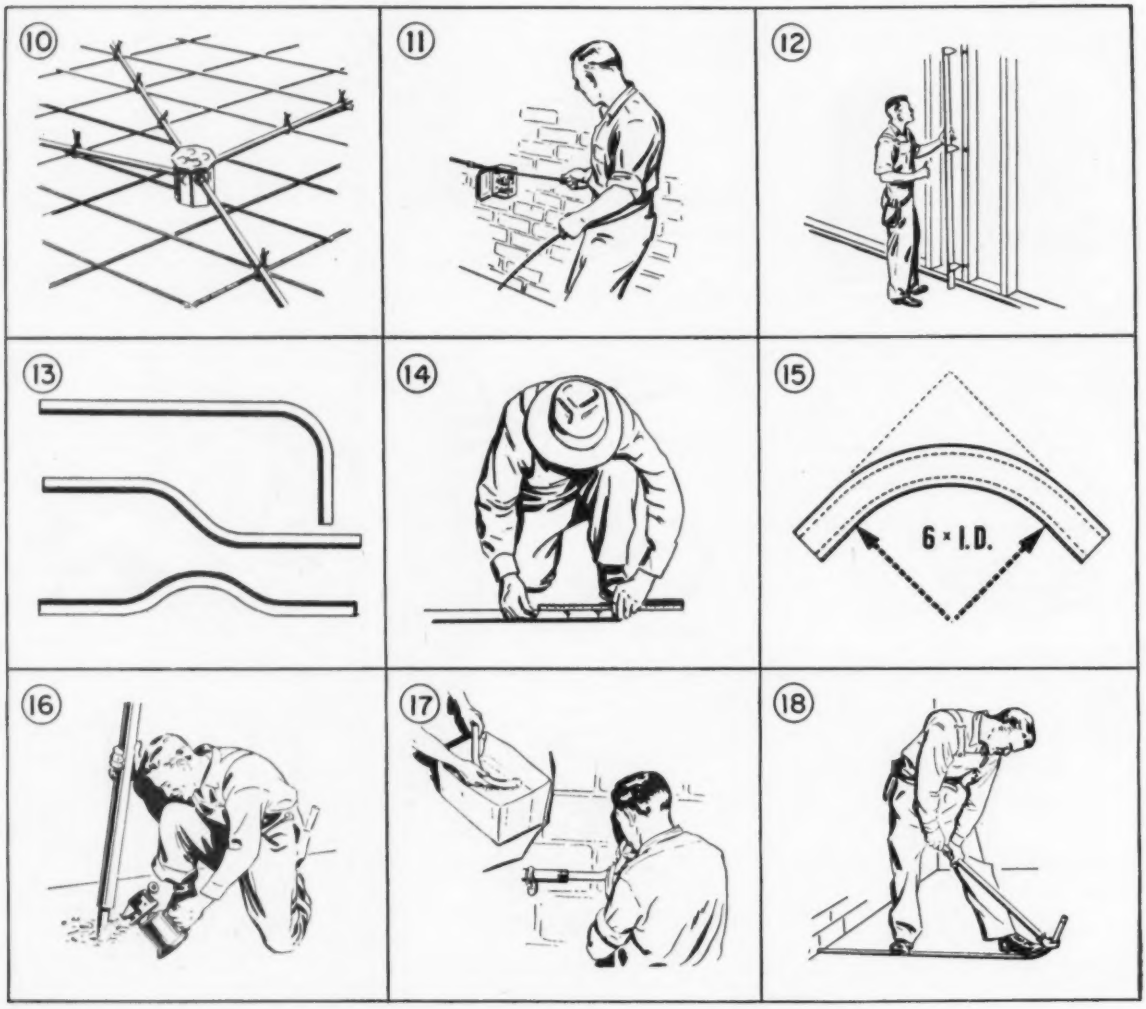
Practical Hints for Installing Rigid Conduit



QUALITY CRAFTSMANSHIP depends in large measure upon fundamental-every-day operations such as the installation of rigid conduit. In fact, the worth of a contractor is frequently measured by the know-how which he exhibits in performing these basic, repetitive tasks. Therefore an occasional visual refresher is in order to keep in mind such details as (1) always storing conduit *vertically*, so that moisture will drain off, corrosion at contact points will be minimized and dangerous rolling hazards eliminated, (2) lubricating dies frequently during the entire cutting process to insure the sharpness of threads, (3) standing the hickey on the floor and using the *conduit* as a lever to make neat offsets, bending until straight legs are parallel to one another, (4) anchoring the grounding conduit securely to the wall, then attaching the ground clamp to the water pipe at a point where it will not be subject to mechanical damage, (5) filing or drilling small holes at the lowest points of long conduit runs so as to drain off the condensation, (6) running conduits *over*, not under, an obstruction, thereby eliminating water traps and resulting damage to wire insulation, (7) using proper anchoring devices for exposed runs on masonry surfaces, remembering that wooden plugs frequently decay or shrink, (8) using scrap paper to keep concrete or plaster from filling up boxes and conduits when floors are laid, (9) cutting notches in wood studs just deep enough to take the conduit's full diameter, thereby weakening the structural member as little as possible,

Data Sheet

Practical Hints for Installing Rigid Conduit *(continued)*



(10) tying conduits to reinforcing rods and supporting conduits with blocks or saddles prior to the pouring of concrete in flat-slab construction, since subsequent movement of these metal members would weaken the slab, **(11)** looping the free end of wire around the body and pulling directly *away* from the conduit in order to obtain maximum leverage with minimum abrasion to wire insulation, and **(12)** marking outlet heights on a stick for fast spotting of convenience outlets, switches and wall fixtures at standard heights of 18, 48 and 66 inches above the floor. Other important facts to remember are that **(13)** the NEC permits 4 one-quarter bends in an unbroken conduit run, counting an offset as a ¼ bend and a saddle as two ¼s, **(14)** the length of a conduit run should include an extra ⅜-inch at each outlet box to allow for the thickness of the box wall, bushing and locknut, **(15)** an ell should not be bent with a radius smaller than 6 times the internal diameter of the conduit, **(16)** bending of conduit may be made easier by first warming the conduit with a blowtorch, **(17)** soapstone or talcum to facilitate wire pulling may easily be applied to the inside of a conduit run by scooping it from a box with a small conduit elbow, then blowing it into the run, and **(18)** when bending an ell, keep one foot firmly on the conduit and place the free end against a wall to prevent any possible back thrust. Illustrations are presented through the courtesy of the American Iron and Steel Institute.

THE THREE CUTLER-HAMMER STARS

★ ★ ★

STAND FOR THREE NEW STANDARDS

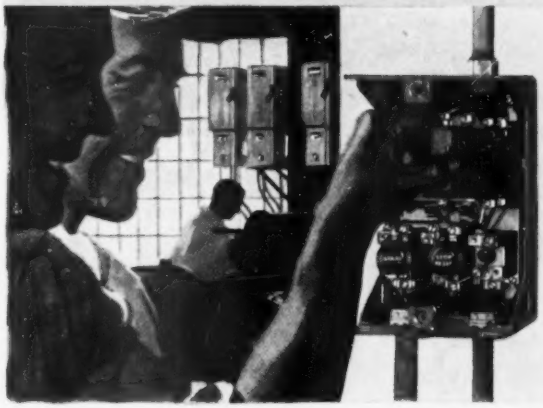
☆ *installs easier*

☆ ***works better***

☆ *lasts longer*

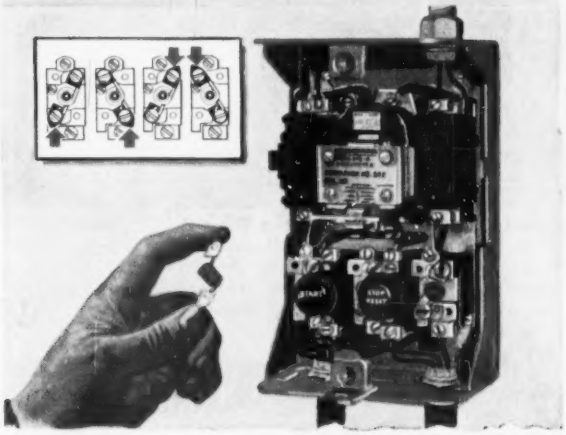
Electrical interlocks...

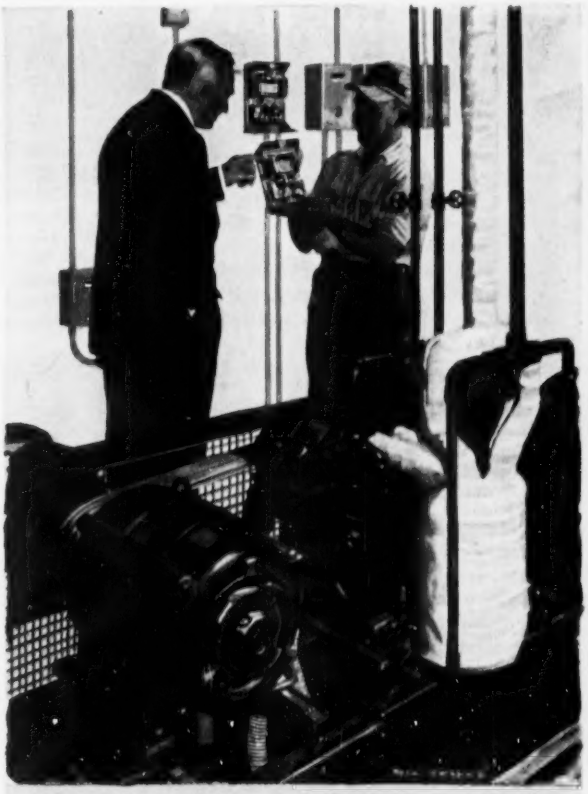
Up to four extra control circuits may be added by simple installation of interlock blocks. Contacts can be normally open, normally closed, or both. A screw driver is the only tool needed.



Adjustable overload coils...

Each heater coil can be placed in any of four positions to permit adjustment of the overload protection to within 3% of the motor rating...compared to 10% or 12% on competitive control.

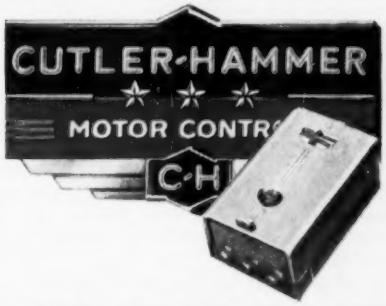




Full three-phase protection...

Another Cutler-Hammer "first." Now the widely demanded three-coil overload protection, so necessary to prevent single-phasing motor burn-outs, is here as an optional feature in standard starter constructions and enclosures. *Complete* 3-Phase protection ...without the high cost of special starter assemblies or the many problems of cumbersome off-size enclosures.

Better performance is more than a mere claim in the spectacular new Cutler-Hammer ☆☆☆ Motor Control. Field tested for more than two years in hundreds of the most difficult jobs before it was ever released for sale. Compared with every make of control by actual users...to have most say, "Better than anything we have ever used." Loaded with new features, a few of which are described all too briefly above. Try it now! Order from your nearby Cutler-Hammer Authorized Distributor today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.



CUTLER-HAMMER ★★★ MOTOR CONTROL

In The News

New Federal Agency to Serve Business

Establishment of a new Federal agency, the Business and Defense Services Administration, was announced October 1, 1953 by Sinclair Weeks, Secretary of Commerce. This new agency, a primary organization unit in the U. S. Department of Commerce, replaces the old National Production Authority, now abolished.

Establishment of the new BDSA a) continues the residual defense and mobilization functions of the former National Production Authority, b) consolidates five departmental offices, c) establishes 25 industry divisions, staffed by business experts from government and private industry, and d) provides a focal point for effective cooperation between government and business in promoting economic stability and growth.

Offices in the Commerce Department now transferred to the BDSA are 1) Office of Technical Services, 2) Office of Distribution, 3) Field Service, 4) staff functions of the Industry Evaluation Board, and 5) Office of Industry and Commerce, including its Trade Association, Commodities Standards and Area Development Divisions.

In announcing the new agency Secretary Weeks said, "The Business and Defense Services Administration is a new consolidated agency, developed for modern conditions and geared for practical programs of teamwork between government and business in serving the best interests of all the people through an organized exchange of timely ideas, information and services.

"In addition to its functions in the area of defense production and planning, BDSA is primarily an agency designed to serve business, to promote the expansion of employment opportunities, and in many ways to stimulate economic growth and stability—thus benefiting savers, managers, workers, consumers and the general public," he explained.

BDSA will be a listening post and sounding board for bringing business information and business opinion on vital matters relating to government and industry, including reports on business conditions, to the direct attention of the Commerce Department for appropriate action. One phase of all this, it was pointed out, is greater cooperation between the Department

NEW IAEI OFFICERS CONFER following executive council meeting of the International Association of Electrical Inspectors at Chciago. They are (L to R): Rene LaBelle, Toronto, representing the new Canadian section until it selects its vice president; second vice president—H. G. Ufer, Los Angeles; president—B. A. McDonald, Rochester, N. Y.; first vice president—S. R. Todd, Chicago; fourth vice president—Dewey L. Johnson, Atlanta, Ga. Third vice president E. B. Morrison, Portland, Oregon; and secretary-treasurer C. L. Smith, Chicago, complete the international officer group which takes office January 1st.

WESTERN SECTION IAEI OFFICERS elected at the Silver Jubilee meeting in Chicago are (L to R): R. V. Moore, Anderson, Ind., executive committee; first vice president—J. E. Fisher, Elkhart, Ind.; retiring president J. C. Denner, Saginaw, Mich.; president—C. M. Park, Chicago; and secretary-treasurer—H. L. Parks, Charleston, W. Virginia. Glenn Rowell, Minneapolis, is second vice president.

FIELD PROBLEMS and pertinent national electrical code interpretations are discussed at electrical inspector session in Milwaukee, Wis., by this expert panel: (L to R) George Andrae, Herman Andrae Electric Co.; William Harnack, Local 494, IBEW; Orville Nichols, A. C. Electric, Inc.; and Grover Kruecke, chief electrical inspector, Milwaukee.

You get ALL these Features when you buy PET Drills!

Reserve Power—for the extra-tough job.
Powerful, Continuous-Duty Motors—built in PET's own factory. Dynamically Balanced Armatures—for freedom from vibration.
Six Heavy-Duty Ball and Needle Bearings.
Compact Design—makes hard-to-reach drilling jobs easier and faster.
Aluminum-Alloy Die Castings—for light weight, easy handling.
Forced Ventilation—for cool running.
Precision-Cut, Heat-Treated Gears—for smooth, quiet power flow.

If you want the *best* for your maintenance or production work, take an extra look at the PET Superduty Drill shown here. Check its features! Here's a drill that's made for heavy, continuous duty...with *plus* power per pound . . . built to *work* right and *handle* right on the job.

Normally you might expect to pay extra for such features—in the form of "optionals" that jack up your cost. But that's not true of PET Drills! All these features are standard in the PET Superduty line . . . *and they're available to you at a standard drill price!* That's why the coupon below can save money for you. For free catalog and name of your nearest PET distributor, *mail it today!*

NOW...you can get the RIGHT DRILL for YOUR job!

PET Superduty Drills are available in 54 distinct models and 3 capacities: ¼", ⅜" and ½". Your choice of pistol or saw-type grip. With such a broad line, you don't have to compromise on a drill that's "almost" right! You can choose *exactly* the drill you need for your job. The PET Superduty line includes drills meeting U. S. Government and military specifications.

PET® POWER TOOLS

Plus Power per Pound

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PORTABLE ELECTRIC TOOLS, INC. EC-113
320 W. 83rd St., Chicago 20, Ill.

Gentlemen: Please send us free copy of your PET Superduty catalog, and name of nearest distributor.

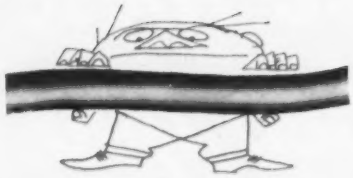
*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

go ahead and be a brute!



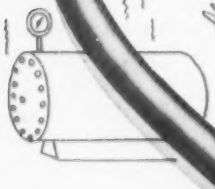
you don't have to baby

BRONCO 60 Certified portable cords and cables

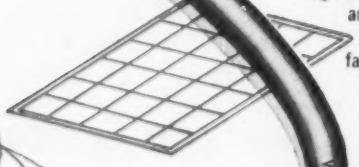
Don't worry about oil, acids, alkalies . . . BRONCO 60 Certified has a jacket rich in oil and chemical-resistant Neoprene. It is **certified** to contain not less than 60% Neoprene **by weight.**

Sunlight? Ultra-violet rays? Ozone? They can't break down the 60% Neoprene protecting jacket on BRONCO 60 Certified.

As for heat . . . Flexibility and life are in no way impaired by temperatures as high as 167° F. BRONCO 60 Certified will not support combustion and bears the symbol P116BM to prove it.

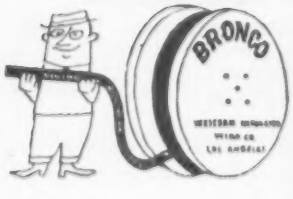


Crushing holds no terrors. BRONCO 60 Certified is extra-resilient as well as extra-flexible because it is vulcanized by a unique method exclusively Bronco's. It "gives" under impact like a super-balloon tire.



Rough edges and sharp corners aren't much of a threat. In any inhabitable factory the edges aren't rough enough or the corners sharp enough to damage tough BRONCO 60 Certified.

A temporary overload is not likely to harm BRONCO 60 Certified because this cable is built with a generous extra margin of safety — electrical as well as mechanical.



WESTERN INSULATED WIRE CO.
Los Angeles 58, California
Sold nationally by Electrical Wholesale Distributors

MEET ARTHUR W. DANFORD, energetic manager of the North Central Ohio Chapter, National Electrical Contractors Association. With the organization since 1950, he makes his headquarters in Akron, the nation's tire manufacturing center, and serves some 41 contractor members.

and industry groups and trade associations.

With the NPA now abolished, BDSA will, in carrying out its emergency responsibilities, preserve the nucleus of an organization which can rapidly be expanded in the interest of national security. It will also foster an orderly transition from emergency mobilization efforts to the operation of a free enterprise system.

The new BDSA embraces three staff offices and 25 industry divisions. The three staff offices are 1) Office of Technical Services, 2) Office of Small Business, and 3) Office of Distribution.

The Office of Technical Services is a cleaning house for Government technological data of interest to business. It will also assist industry in voluntary product standardization, and in regional and local area development problems. It is comprised of the Area Development, Commodity Standards and Trade Association Divisions.

The Office of Small Business is the focal point in the Commerce Department for liaison with the Small Business Administration.

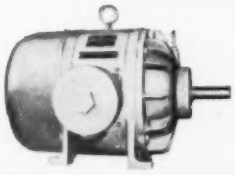
The Office of Distribution is the focal point in Commerce Department for the retail, wholesale services and distributive trades on marketing and distribution programs and policies.

The Office of Industry divisions embrace 25 separate industries, and is in effect the carry-over of the now abolished National Production Authority. It forms the framework for an organization capable of rapid expansion as an operating agency of production and materials controls in the event of a future national emergency.

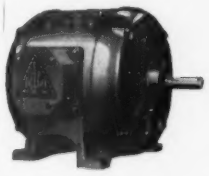
DEPENDABILITY...

that minimizes costs

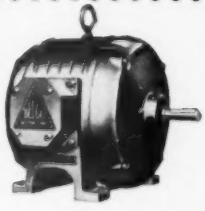
Delco Motors



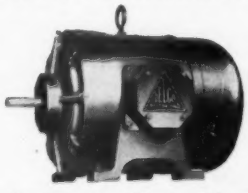
Explosion-proof motor



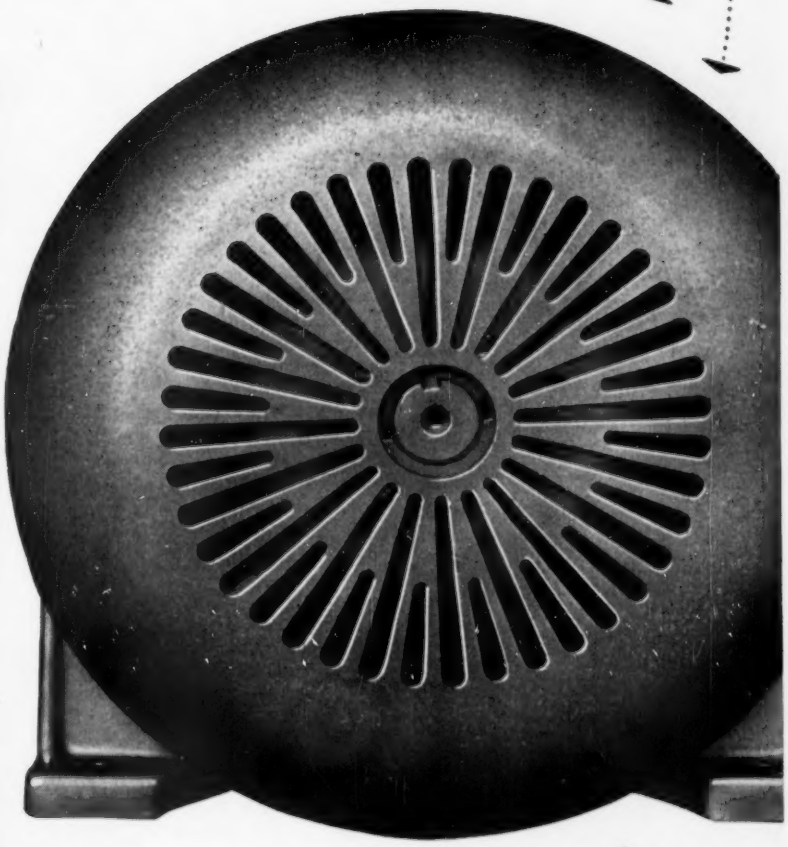
Open ball-bearing motor



Totally enclosed ball-bearing motor



Totally enclosed fan-cooled motor



With Delco integral motors on your machines you have a cost factor on which you can depend.

For Delco designs and builds with one idea in mind—to produce motors that will run dependably, under extreme conditions, for record-breaking periods of time.

Put your trust—and your motor dollars—in Delco motors . . . your nearest Delco sales office will help you with all details.

DELCO DAYTON OHIO

DELCO PRODUCTS

Division of General Motors Corporation
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ROYAL

ENGINEERED FUSES
for dependable
protection

ROYAL-NOARK
NON-RENEWABLE
5
ways better
on the
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use them on
EVERY JOB

ROYAL-NOARK
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easiest
to
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Engineering improvements in the design and construction of ROYAL-NOARK cartridge fuses mean that they stay cooler . . . give greater protection to vital equipment.
. . . ask your wholesaler

ROYAL
Quality
WIRE • CARTRIDGE FUSES
famous ROYAL "Crystal" PLUG FUSES
ROYAL ELECTRIC CO., INC. PAWTUCKET, R. I.

CALIFORNIA INSPECTORS chosen as officers of the Southwestern Section, IAEI, are (L to R): secretary-treasurer—L. E. LaFever (immediate past president) of Alhambra; president—E. E. Carlton, San Francisco; first vice president—Ben H. Wheater, Long Beach. James L. Ambrosi, Oakland, is second vice president of the group.

Included in the 25 industry divisions is the Electrical Equipment Division, staffed by business experts from government and private industry transferred to the new agency from the Electrical Equipment Division of the old NPA. Heading this group is Bonnell Clark, Director, a retired vice president of Westinghouse Electric Corporation, serving on a rotation basis from industry. Serving as Deputy Director is Carney G. Laslie, a government career employee with executive experience in both the old War Production Board and NPA, who is also responsible for the Division's Services to Business section. Supervision of the Foreign Trade and Industrial Expansion section is by Howard Way, a career employee with the Department of Commerce for many years in this same field, who also assists Carney Laslie in the Services to Business section.

Warren Hoffman, a retired General Electric industry specialist, heads up the Mobilization Requirements section as well as the Rotating Equipment section. The Scheduling and Expediting for Defense Procurement section is supervised by Col. L. Alan Sharp, retired from the U. S. Air Force, and a former official of the National Electrical Products Corp., who also served in a similar capacity in NPA. Col. Sharp also heads the Interior Wiring Systems section as an industry specialist.

Headquarters office for the Electrical Equipment Division of BDSA is Room 4112, located on the fourth floor of the Department of Commerce building at 14th Street and Constitution Avenue, Washington, D. C.

The Electrical Equipment Division is responsible for various defense production, mobilization preparedness, and business services' activities. These include actions in support of military and atomic energy programs, review

ROYAL

RIGHT CONTACT
for dependable
wiring devices

CAPS

No. 55 No. 31

CONNECTORS

No. 42

use them on
EVERY JOB

No. 43
"ROYALOK"
RECEPTACLES

No. 99

Sound engineering, quality materials, and experienced manufacturing skill make ROYAL wiring devices better for you these three ways: 1) they're easy to wire; 2) always dependable; and 3) long life under constant use.
. . . ask your wholesaler

ROYAL
Quality
WIRE • CARTRIDGE FUSES
famous ROYAL "Crystal" PLUG FUSES
ROYAL ELECTRIC CO., INC. PAWTUCKET, R. I.

Now... set fastening studs wherever they're needed
MODEL 450 REMINGTON STUD DRIVER
Here's new economy . . . new speed in construction fastening! The Remington Stud Driver joins wood or steel sections to concrete or steel surfaces in seconds . . . easily sets as high as 5 studs a minute. Powerful 32 caliber charges drive studs arrow-straight. The tool's light weight—only 5½ pounds—simplifies handling wherever studs are needed.
New guards for specific uses now make the self-powered Remington Stud Driver more versatile than ever. These attachments take all the guesswork out of stud location . . . assure fast, accurate fastening for every job. Illustrated are just 4 of these special guards. For full information about the complete line and about the Remington Stud Driver, send the coupon below.
A complete line of guards for special applications
Guard for Structural Channel
Guard for Switch, Utility and Outlet Boxes
Guard for "Unistrut" Sections
Guard for Conduit Clips
Listed & Approved by Underwriters' Laboratories, Inc.
MAIL THIS COUPON TODAY
Industrial Sales Division, Dept. ECM-11 • Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut
Please send me my free copies of the new booklets showing how I can cut my fastening costs.
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"If It's Remington—It's Right!"
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ELECTRO DYNAMIC
Extra dependable industrial motors
1 TO 250 HORSEPOWER (N.E.M.A. STANDARDS)
Extra large "free-flo" air channels.
Liberal size grease lubricated bearings.
One-piece cast iron frames.
Permanently aligned cast iron brackets.
Also a complete line of Direct Current motors and generators
ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY
HEART of the motor
3. Extra high-frequency testing of insulation between turns.
4. Extra care in fitting coils into stator.
The WINDING is the
1. Extra insulation in stator slots and between phases.
2. Extra impregnations and bakings of the wound stator.
QUALITY SINCE 1880
WRITE TODAY FOR NEW ILLUSTRATED CATALOGUE NO. 1171

BUSY EXECUTIVE is L. B. Oaks, partner of Oaks & Vogel Electric Company in Akron, Ohio. In addition to his administrative responsibilities Mr. Oaks, who has been in the electrical construction field for some 35 years, serves on the Electrical Examining Board of Akron (for licensing electrical contractors) and represents the local NECA Chapter of the NECA Board of Governors.

and recommendations on expansion goals, tax amortization, and domestic loan applications to Office of Defense Mobilization, recommendations on stockpiling or disposal of stockpiled strategic materials and equipment, participation in the Mobilization Base program, collection, analysis and dissemination of basic data and information needed by mobilization authorities, other government agencies, and business, and to assist domestic business in its relations with other departments of the Government.

BDSA is under the authority and supervision of Carl F. Oeschle, Acting Asst. Secretary of Commerce for Domestic Affairs. H. B. McCoy, Deputy Administrator of BDSA, is Acting Administrator pending selection of the Administrator by Secretary Weeks.

WINNER OF AN UNUSUAL prize at the IAEI Silver Jubilee meeting in Chicago, W. H. Newton, electrical inspector, Rockville Centre, N. Y., receives registered, pedigree English bull puppy from James Galbraith representing Bull Dog Electric Products Co., Detroit, the donor.

DUTCH BRAND
Insulating Foursome...

EVERY ONE A SPECIALIST IN MEETING INSULATING REQUIREMENTS

DUTCH BRAND FRICTION TAPE

A friction tape with known and proven quality . . . for over forty years. Non-raveling . . . strong . . . 4 ply process . . . correct adhesion . . . no pin holes . . . high dielectric splices . . . 2000 volts for a single thickness . . . long life. It costs no more to have this top quality tape . . . ask for DUTCH BRAND the next time you order.

DUTCH BRAND PLASTIC TAPE

Years of manufacturing experience are responsible for this outstanding tape . . . made especially to meet electrical requirements. It is thin and flexible . . . with 150% stretch. It adheres to irregular shaped surfaces, is excellent for use where space is limited. It resists weather, oils, acids and corrosive chemicals. Dielectric resistance averages 1000 volts per mil of thickness. Available in regular .007" thickness or heavy duty .010" thickness for heavy duty work—for use with power driven tape machines. Specify DUTCH BRAND Plastic Tape.

DUTCH BRAND RUBBER INSULATING TAPE

DUTCH BRAND Rubber Insulating Tape fuses instantly without heat and has the high dielectric quality for good splices. It resists up to 18,000 volts through a single thickness. It contains no corrosive chemicals . . . it has long life and is dependable. DUTCH BRAND Rubber Insulating Tape serves a very definite unreplaceable service under electrical codes to meet many electrical insulating requirements.

"DB" WIRE CONNECTORS

"DB" Wire Connectors are DUTCH BRAND top quality products . . . made to exacting specifications and design. Long skirt for full insulating protection . . . made of phenolic material, they are weatherproof . . . vibration proof and resist pull-out, making perfect solderless connections. The knurled design makes them easy to handle and apply. They are available in four standard sizes, DB-1, DB-3, DB-4, DB-6.

ORDER FROM YOUR ELECTRICAL WHOLESALER

DUTCH BRAND

VAN CLEEF BROS. INC.
Manufacturers of Rubber Products
DIVISION OF Johns-Manville
7800 WOODLAWN AVE. • CHICAGO 19, ILLINOIS

DO THESE AND MANY JOBS FASTER AND EASIER WITH *INSTANT LIGHTING*

BERNZ O MATIC

TORCHES WITH DISPOSABLE FUEL CYLINDERS!

BANTAM—Has needle-fine flame for close work and for occasional torch use.

MASTER—Is the ideal torch for linemen and contractors, for heavy duty day-to-day service.

Both torches are light in weight (MASTER, less than 3 lbs. BANTAM, less than 2 lbs.), compact and portable, fit neatly in tool box or pocket. Both have disposable cylinders containing enough fuel for hours of normal use. Burn at 2300° F. Catalog sheets give details. Mail the coupon for your copies today.

OTTO BERNZ CO., INC. ECM
280 LYELL AVE., ROCHESTER, N. Y.

Please send me catalog sheets on the Bernz-O-Matic Master and Bantam Torches.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

INCOMING PRESIDENT of Illuminating Engineering Society is A. Homer Manwaring, vice-president, Philadelphia Electrical & Manufacturing Co., Philadelphia, being congratulated by outgoing president Everett M. Strong, professor of electrical engineering at Cornell University, Ithaca, N. Y., during recent IES National Technical Conference in New York.

Adequate Wiring Is Theme Of National Electrical Show

Over 11,250 electrical contractors, wholesalers, architects, engineers and home owners converged on New York City's 69th Regiment Armory during the 4-day span of September 29-October 2 to inspect products exhibited by 131 firms represented at the Second National Electrical Industries Show. "Safety Through Adequate Wiring," the theme of this year's exhibition, was stressed effectively by charts, wiring mock-ups, illustrated literature and numerous cut-away models of products that contribute to greater safety, convenience and efficiency in the home, the factory or the office.

Many displays illustrated the fact that wiring installed to conform to various building codes is not necessarily adequate for the demands of modern living, and that wiring designed to serve a handful of lighting fixtures several decades ago cannot possibly carry the power required to operate such additional load-creating equipments as water heaters, washers, ranges, air conditioners, roasters, freezers, food disposal units and the like. Safety features of fuses, circuit breakers, grounded receptacles, 3- and 4-way switching, low-voltage remote control, automatic cut-off devices and other equally-protective products were clearly illustrated and discussed by representatives in many of the display booths.

Sponsored by the Eastern Electrical Wholesalers Association and directed by Harold R. Meyer and William S. Orkin, the show featured not only wiring, conduit, panelboards and switches, but products designed to further residential beauty, convenience and all 'round utility. This category of displays included lighting fixtures, chimes,

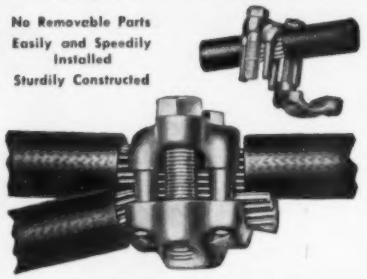
CLAMP AND LOCK YOUR CONNECTIONS { THE K&H WAY

This

SWIVEL U-BOLT CONNECTOR

is designed to do just that...

No Removable Parts
Easily and Speedily Installed
Sturdily Constructed



MEET ALL REQUIREMENTS

85% Copper Alloy • Ample Strength
High Conductivity • Unaffected by Vibration
Moisture Resistant
Sizes Up to 1,000,000 CM.
Approved by Engineers

Specify K&H for YOUR Next Job

For More Details, Sizes and Prices
WRITE FOR CATALOG 5LC

KRUEGER & HUDEPOHL
232-8 VINE ST • CINCINNATI 2, OHIO

Control **MAXIMUM PRODUCTION**

with **G. S. SPEED INDICATORS** *and* **HAND TACHOMETERS**

1% Accuracy for any range from 30 to 100,000 RPM or surface speed.

Antimagnetic durable mechanism.

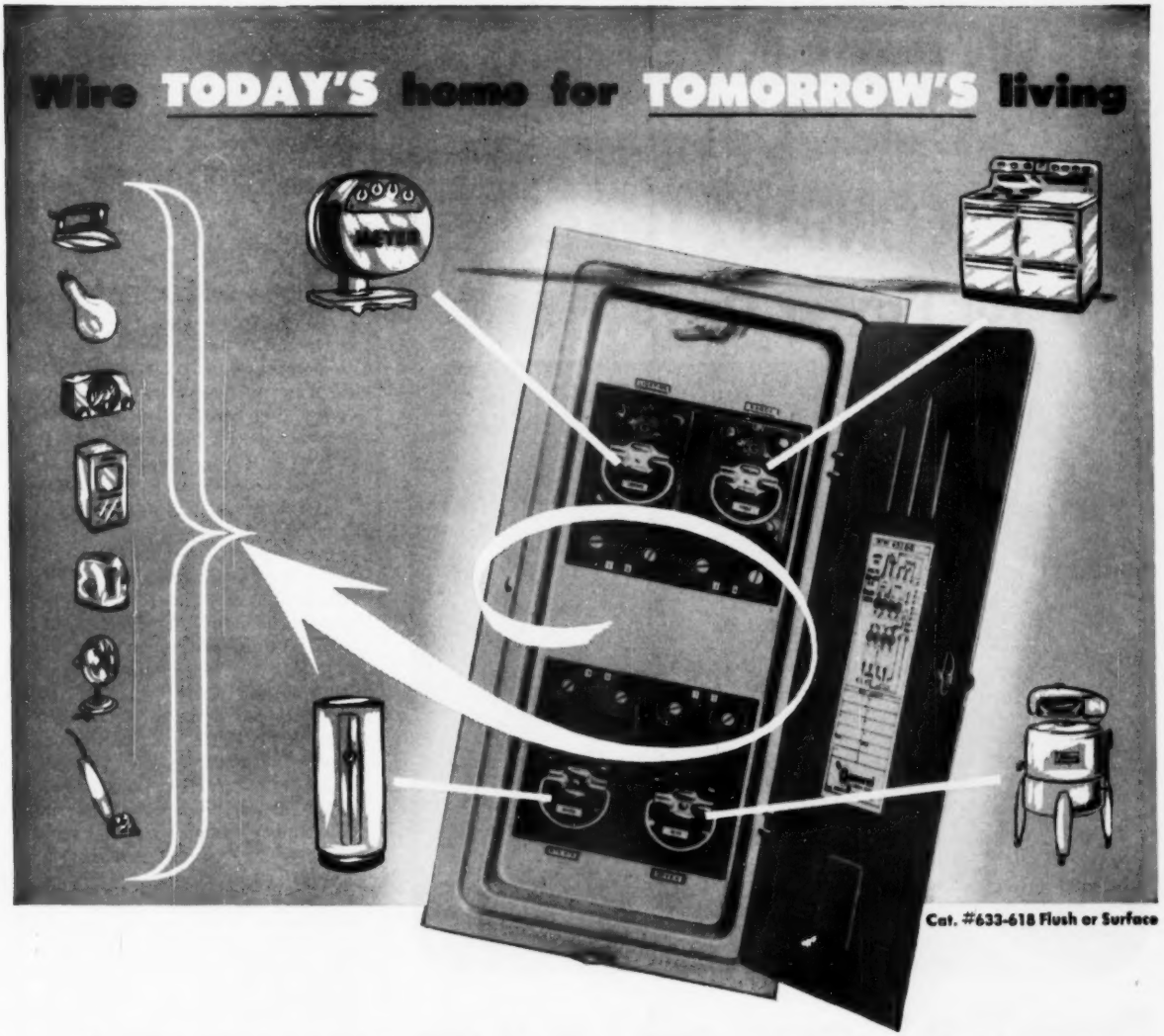
Efficient repair service at moderate charges.

IDEAL FOR MOTORS — SHAFTS SPINDLES — LOOMS — TURBINES FOR TEXTILE AND POWER PLANTS

WRITE FOR ILLUSTRATED FOLDER

GEORGE SCHERR CO., Inc.
200 EC LAFAYETTE ST. • NEW YORK 12, N.Y.

Wire TODAY'S home for TOMORROW'S living



Cat. #633-618 Flush or Surface

General brings you a "Main and Range Plus"! The *quadruple* pullout unit that actually plans for the future. Not only does this all-in-one unit take care of today's wiring requirements . . . it *anticipates* tomorrow's needs. Eliminates costly auxiliary wiring equipment, and unsightly additions. The General Quadruple Pullout unit is neat, compact, thoroughly dependable. It saves you time and materials . . . at a price you want to pay. No wonder wholesalers and contractors all over the country are saying: Switch to General today! Available everywhere exclusively through wholesalers.

100 Amp. main lugs feed 4 pullouts connected in parallel. One 60 Amp. functions as a main disconnect for eight 30 Amp. plug-fuse branch circuits and the 60 Amp. sub-feed lugs. Three additional pullouts (one 60 Amp. and two 30 Amp.) control appliances such as, Ranges, Water Heaters, Dryers, etc. Other combinations may be ordered.

Sales Offices in every Major City

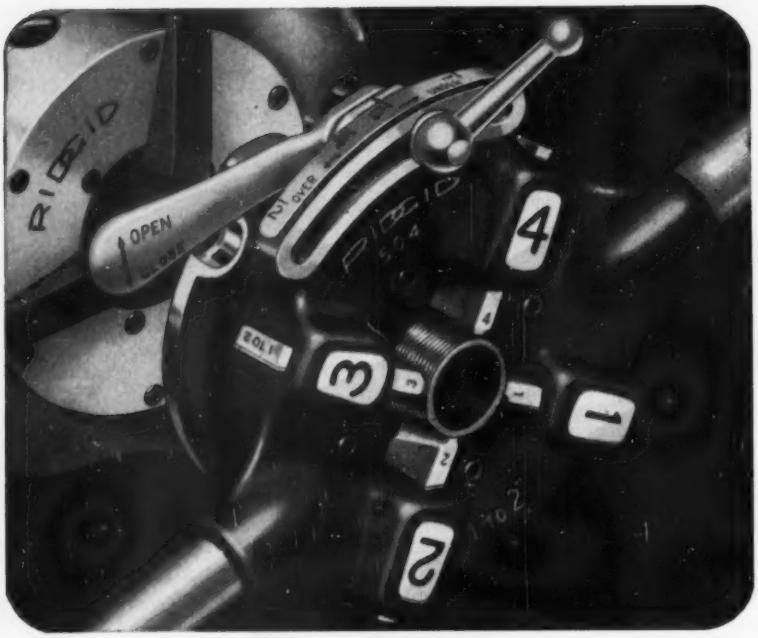
General Switch Corp.

Write for catalog #5201

45 ROEBLING ST. • BROOKLYN 11, N. Y.

ENCLOSED SAFETY SWITCHES • SERVICE ENTRANCE EQUIPMENT • BRANCH CIRCUIT PANELS

NEW RIDGID
Quick-Opening
"504" CONDUIT THREADER
for Power Drive use



Threads 1" to 2" conduit with 1 set of dies

You can't beat this new "504" for fast smooth threading with power drive! Changes instantly from size to size regardless of position of quick-opening lever . . . Release ball handle, move indicator line to 1", 1¼", 1½" or 2" on size bar, tighten—it's ready to thread! Quick-opening handle retracts dies instantly without stopping power drive—no slow backing off. 4-jaw workholder centers conduit for accurate threading. No lead screw to jam. Easy-to-read size bar. Adjustable to over and under size threads. See it, try it—buy new "504" at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

power tools, motorized equipment and appliances. It may be said that the show accomplished two worthwhile objectives, displaying to the public these products which are available for maximum modern electrical living, and educating the industry as to the urgent necessity for installing or modernizing wiring systems which may adequately serve those load-building products.

Southeastern Contractors Met in Birmingham

Electrical contractors of the Birmingham, Ala., chapter of NECA are going after business in a big selling program to test the extent of the volume of business that can be obtained through planned selling.

At a meeting in Birmingham Oct. 2, 3, NECA members and chapter managers from 13 Southeastern States heard the Birmingham plan and discussed ways in which the program can be stimulated in other chapters.

P. Howard Farley of NECA told the meeting that the national advertising program can be successfully used by local contractors to stimulate their sales efforts. Thus local members can receive reprints of national advertising to send to prospective customers along with their own promotional material.

Mr. Farley pointed out that there is a $700-million market for office lighting fixtures representing replacement of merely the obsolete equipment. If factory and commercial business available in a modernization program is considered the possible equipment sales market will run to more than a billion dollars. "This market is waiting to be sold and contractors are in a better

DIVIDEND ON INTEREST shown in manufacturers' displays at IAEI Silver Jubilee meeting in Chicago is received by R. B. Strand (left) of Battle Creek, Michigan. H. C. Moses, Jr., chairman, display committee presents him with first prize in drawing—a pair of sterling silved candelabra donated by the Rockbestos Products Corp., New Haven, Conn.

ENTERPRISING PARTNERS of the electrical contracting firm of Helldoerfer-Castellini hold a project conference. Charles S. Helldoerfer (left) handles engineering, estimating and construction supervision for the progressive 7-year old firm while James H. Castellini devotes his time to the financial and labor-relations aspects of the business.

position to do this particular job than any other segment of the electrical industry," Mr. Farley stated.

Opinion was expressed that direct mail is one of the most effective methods of reaching prospective customers and increasing business. One contractor pointed out that he uses a card system, with customers classified, to send out specific promotional material.

Discussion brought out that the contractor has a great opportunity to become the dominant figure in the sales market by selling a package job and guaranteeing both work and equipment.

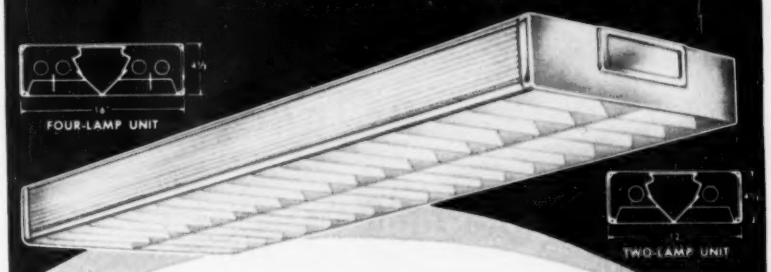
During the first day A. F. deFuniak, division supervisor of commercial sales of Alabama Power Co., discussed the fundamentals of salesmanship and pointed to methods which the contractor can employ to do a selling job. He declared that time is now at hand when the contractor must do a hard selling job and not just make bids on every job that comes along and hope to obtain a share of the market.

There was agreement that the electrical contractor has a wide open field to do factory, office, building, hotel, etc., maintenance work on a better basis by contract than is now practiced by some owners.

Suggestion was made that contractors retain a qualified consulting engineer to make plant surveys and to recommend changes necessary in plant electrical systems, better lighting and improved electrical operations. Suggesting these plant improvements would lead to increased business for the contractor.

From national NECA headquarters came President Don B. Clayton, Charlie Moseley, vice-president of NECA and Jim Donohue to discuss advertising and sales promotion with

SO MUCH MORE **UTILITY** THAN YOU'D EXPECT . . .



IN A LUMINAIRE OF SUCH RADIANT *Beauty*

GARCY **Starliner**
OVER 80% EFFICIENCY • 30° x 40° Shielding
. . . yet only 4½" Deep

Slim, trim and functional in appearance, the Garcy Starliner lends itself beautifully to contemporary styling. When surface mounted, its shallow contour economically simulates built-in lighting.
Yet within its compact design, this luminaire embodies every wanted feature. Side panels of Corning's Alba-lite glass are attractively framed in protective metal rails . . . promote efficient light distribution while contributing to proper brightness control. Garcy's louver design provides 30° x 40° shielding.
The Starliner is superbly made . . . note the round edges on end plates and side rails. Economically installed, easily maintained. Available as two-lamp or four-lamp units in 4 ft. or 8 ft. lengths for standard fluorescent, rapid start or slimline lamps. Write for Bulletin L-134.

FAST, LOW-COST INSTALLATION
with Garcy Sliding Clamp Hangers for easy alignment, both vertically and horizontally. Adjustable in height by simply turning stem.

ECONOMICAL MAINTENANCE
Single louver shield permits relamping two 8 ft. fixtures from one ladder position.

STURDY CONSTRUCTION
V-shaped backbone securely holds louver cross-fins under spring tension . . . prevents looseness, rattle or "sing."

GARCY

GARDEN CITY PLATING & MFG. CO.
1730 N. ASHLAND AVE., CHICAGO 22, ILLINOIS
In Canada: Garcy Co. of Canada Ltd., 191 Niagara St., Toronto

Quick as a wink measure both AC and DC

WITH A COLUMBIA TONG TEST AMMETER

(Voltage attachment available)

- Both AC and DC ampere readings are made instantly and accurately without breaking circuit or scraping insulation
- Operated with one hand by merely clamping tongs around conductor
- Cannot burn out
- Scale ranges up to 1000 amperes AC or DC
- Voltage attachment reads up to 600 volts
- Five types to accommodate cables up to 3⅞", bus bars up to 4½"x½"

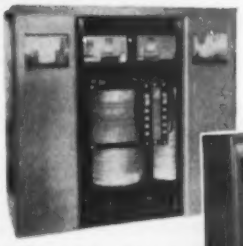
Write for Tong Test Bulletin CM-400

COLUMBIA ELECTRIC MFG. CO.
4541 Hamilton Ave. Cleveland 14, Ohio

Want the Better* TRANSFORMERS?

We build them . . . with modern materials and engineering techniques . . . plus up-to-date design . . . based on years of experience.

Here is a typical air-cooled 500 KVA class B type. 80°C Rise. 3 phase 4160 Delta Primary + 2½% full capacity taps. 240x480 Delta Secondary. Available from 30 to 2500 KVA with voltages from 2400 to 15 KV.



Open

Closed

Distribution Transformers (Dry Type)

* If you think this is just an advertising adjective we invite you to contact us—we will tell you who buys Magnatran—the better transformers . . . and if you want, show you how we build them.

DRY TYPE
Indoor or Outdoor (3 KVA to 15 KVA Air-cooled)

MAGNATRAN

Meets Standards of AIEE-NEMA

MAGNATRAN INCORPORATED
TRANSFORMERS AND ELECTRICAL EQUIPMENT
Walter Garlick, Jr., President
246 SCHUYLER AVE., KEARNY, NEW JERSEY

WRITE FOR DETAILS

A NAME SYNONYMOUS WITH EXPERIENCE

the Southeastern chapter manager and members.

The program Saturday was devoted to methods which can be employed to stimulate greater interest in the contractor programs and promotional material which would be most effective.

Pay-As-You-Go Rewiring Plan

"Take up to three years to pay as little as $2 a month with your electric bill," say the ads for Cincinnati's newest promotion campaign to finance home wiring modernization the time-payment way.

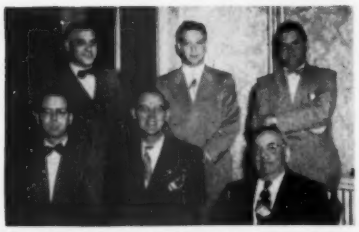
In Cincinnati a group of distributors cooperating with the power companies are sponsoring a novel home wiring campaign called "Target HW". It will attempt to make this needed renovation process as painless as possible for the customer by paying for up-to-date wiring on the installment plan.

Here's how it will work:

Say that a home owner out in the Cincinnati suburbs has decided that she wants an all-electric kitchen. She goes to her dealer and buys the appliances only to find out later that her ten-year-old home's wiring capacity can't stand the extra load.

The contractor is then called in to make an inspection of the wiring system, and finds that the home will need new circuits, heavier-duty wiring, more outlets. The contractor informs the home owner of a simple arrangement he has worked out with the local power companies to pay for the new wiring on the installment plan. The customer agrees on the price and decides whether she wants to pay for the job over 12, 24 or 36 months, and the contractor shows her on a chart exactly what the monthly payments will be.

LYLE E. JOHNSON, right, Juneman Electric Co., Inc., Birmingham, Ala., receiving plaque in lighting contest sponsored by ELECTRICAL CONSTRUCTION & MAINTENANCE from E. Dalton White of McGraw-Hill Atlanta bureau in behalf of editors and publisher. Mr. Johnson won second prize of $50 and plaque for store lighting and honorable mention for floodlighting.



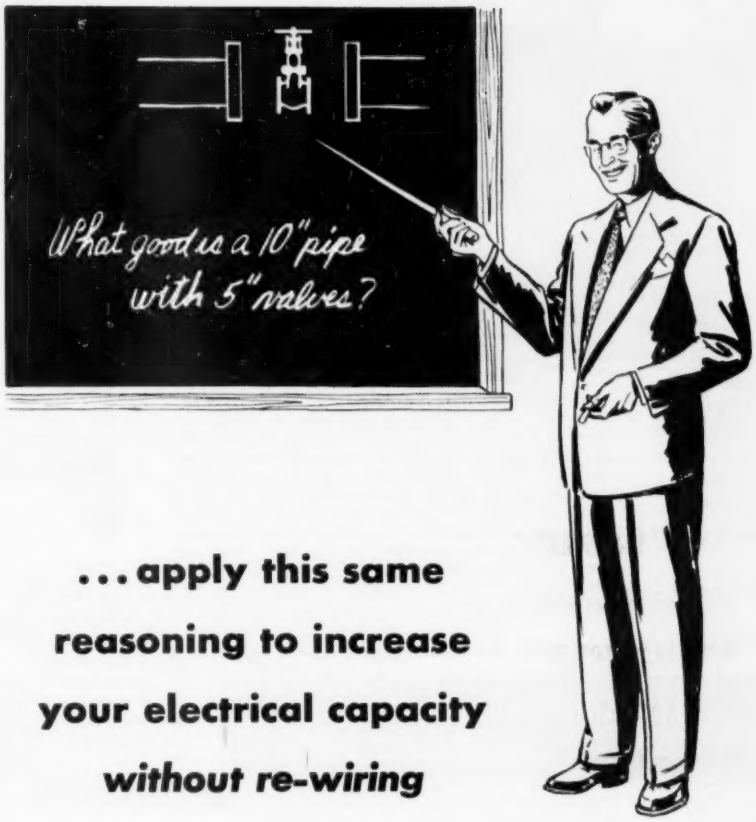
FRANCIS E. HAVENER (seated, right), third prize winner in the Lighting Competition sponsored by EC&M Stores Classification, was presented with his award at the October meeting of the Electrical Associates of Maine in Waterville, Maine. Assisting Mr. Havener in his prize-winning installation were: (standing), Ray McFarland, Director, Lighting Dept., Central Maine Power Co.; George Gowell, Electrical Distributor, Lewiston, Me.; A. W. Fulle, representative, Sylvania Electric Co., So. Freeport, Me.; (seated), Richard K. Havener, son of winner; and Howard E. Rollins, electrical contractor, Camden, Me.

When the contractor finishes his work, both he and the customer fill in the simple agreement and promissory note, and he turns it over to the power company for credit clearance. The power company then pays the contractor the full amount of his bill. From then on, through the period of time the customer has selected, the small monthly payments appear automatically on the monthly electric bill.

The plan—outlined to contractors and dealers at a special kickoff session on October 21—is available to any residential or farm customer now occupying wired premises served with electricity by the Cincinnati Gas & Electric Co. or the Union Light, Heat and Power Co. (The wiring covered by this plan may consist of any and all wiring changes including lighting fixtures) from the end of the power company's facilities to the point of appliance connection. The maximum period over which the cost may be spread is three years; the minimum monthly payment is $2.

NISA News

Southwestern Chapter met Sept. 4-5 in Lubbock, Tex. at the city's Caprock Hotel for an information-packed two day program. The group was welcomed by Mayor Murrel Tripp of Lubbock State Representative Waggoner Carr spoke on "Water Conditions in Texas" and a paper covering unusual varnish applications and hermetically-sealed motors by Ben Scobel, chief chemist of the P. D. George Co. was read by Frank Hippler



...apply this same reasoning to increase your electrical capacity *without re-wiring*

DE-RATING of circuit breakers is like going to the expense of a large pipe line, then installing small valves. Isn't it foolish to install wiring and conduit, for example, rated at 20 amperes, then use circuit breakers or fuses that de-rate the entire system to 12 amperes or less?

For this reason, most plants are never able to utilize the full safe capacity of their branch electrical circuits. This is simply because *most* circuit breakers require *de-rating* to allow for ambient temperature changes.

HEINEMANN Circuit Breakers never need de-rating . . . because their operation is not affected by room or panel box temperature. They do not employ thermal elements . . . so that you can always use the full rated capacity of the line with complete safety. You can have this extra capacity for only the small cost of replacing with Heinemann Circuit Breakers . . . they're interchangeable with most standard breakers.

Write for Bulletin No. 3101.

don't use heat...*USE POWER*

HEINEMANN ELECTRIC COMPANY
132 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

"LIKE WATER off a DUCK'S BACK"

Moisture cannot penetrate the one-piece Neoprene body of a JOY electrical plug . . . when engaged, even its contacts are enclosed in a protective Neoprene housing through the *cork-like* action of JOY'S famous water-seal. Permanently vulcanized to cable, it cannot crack . . . won't lose its shape . . . and requires no special considerations to insure a long life of useful service. A favorite since '26, JOY electrical connectors are now available in styles and sizes for nearly any portable electrical power transmission need. Why risk electrical misfits when the best actually costs less, in the long run? Write for full details including your copy of Bulletin MC108 today!

FREE

MORE THAN 100 YEARS OF ENGINEERING LEADERSHIP

JOY MANUFACTURING COMPANY
HENRY W. OLIVER BUILDING, PITTSBURGH 22, PENNSYLVANIA
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LTD., GALT, ONTARIO

ME 152-3

FREE BOOKLET REVEALS "MACHINE MAGIC"

ONE MAN DOES THE WORK OF 6
WITH THIS REMARKABLE
POWER-DRIVEN BRUSHCUTTER

BRUSHMASTER
REDUCES COSTS! . . . INCREASES EFFICIENCY!

Brushmaster is the talk of the industry . . . and is now proving itself in the field with many and varied companies which must maintain right-of-way clearance. Cuts all brush, from matted grass to saplings 4" in diameter. Operator completely protected, cannot come in contact with blade. One man operated, lightweight, it goes anywhere . . . reaching overhanging branches and vines . . . and cropping close to the ground! Vibration-free, clutch controlled, positive drive. Send for booklet today!

FREE BOOKLET SHOWS HOW TO REDUCE BRUSH CLEARANCE COSTS!

BRUSHMASTER SAW, INC.
84 T EMERALD ST., KEENE, N. H.
Subsidiary of Harrington & Richardson, Inc., established 1871.
Manufactured and sold in Canada by H&R Arms Co., Ltd., Montreal, Canada

OFFICERS OF NEWLY CHARTERED Canadian Section, IAEI, meet at IAEI Silver Jubilee meeting in Chicago. They are (L to R): treasurer—N. A. Cockburn, Toronto; second vice president—Lance Robson, Vancouver, B. C.; president—Rene LaBelle, Montreal; third vice president—W. J. Brake, Regina, Saskatchewan; first vice president—J. A. B. Kembry, Edmonton, Alberta. Fourth vice president is W. D. Smith and secretary is K. Bellamy, both of Toronto.

of Insulation & Wires, Inc. Bill Chumley, G. E. Jones Electric Co. Amarillo, Tex., talked on methods of cost keeping.

Other papers included "Part Winding Start Motors and Controls" by Ralph Mills, Anderson-Young Electric Co., Lubbock, and "Capacitors and Their Effects" by Jack Barber of the Southwestern Public Service, the local utility.

NISA President Bill Hogue attended the meeting and addressed the chapter, discussing the future developments of industry and its importance to independent electrical equipment repair service. Hollis Prowett, General Electric Supply Co. showed a film "Lightning Master." Dinner and entertainment concluded the meeting.

New officers of the Southwestern Chapter are: president J. C. Hardie, Industrial Electric Equipment Co., Dallas; vice-president, Paul V. Bush, Lubbock Electric Co., Lubbock, Tex.; treasurer, W. W. Savage, Savage Electric Co., Wichita Falls, Tex.; secretary, George N. Foshee, Foshee Electric Co., Fort Worth.

• • • •

San Diego Chapter held its regular monthly meeting Aug. 10 with Ted Clute of the Tri-Electricians Company in El Cajon, Calif., acting as host. The group adjourned following dinner and a general discussion of shop problems to inspect the Tri-Electricians shop.

• • • •

Quaker City Chapter's first meeting of the 1953-54 year was held Wednesday, Sept. 9th at the group's regular meeting place, Beck's-on-the-Boulevard. Dinner was served at 7 p.m.

following which G. W. Swartzbaugh, Dow Corning Corp. spoke on "Silicones and Their Applications." New officers of the chapter are: president, Sam Augustine; vice-president, Milt Eisenhardt; treasurer, Bill Hendrickson; secretary, Frank Schaef. Committee chairmen include executive, Ralph Kufen; research, Borden Hoffman; program, Ralph Kufen; by-laws, Joe Previty; membership, Bill Storck; attendance, Joe Wagner; publicity, Art Fowler; special grievance committee, Phil Desiere.

• • • •

Chicago's Central District Chapter met Sept. 8 at the Tower Club for dinner and an exhibit of the winning NISA Award Contest entries.

• • • •

One of the most interesting meetings in the history of the North Central Chapter was held Sept. 12th at the Hotel Duluth, Duluth, Minn. A crowd estimated at 75% of the chapter's membership was on hand for the morning business sessions. A tour of the Mielke Electric Works, Inc. where the group saw excellent utilization of shop space, a wide assortment of equipment, interesting special devices and two dynamic balancing machines followed, and the afternoon was devoted to technical discussion.

• • • •

George Svendsen Sr., Boustead Electric & Mfg. Co., Minneapolis, discussed methods of cost determination, and Warren Mielke of the Mielke firm reviewed the paper of Oscar A. Clot on dynamic balancing in the light of experience with his company's two machines. Fred B. Wipperman, NISA executive secretary, discussed National Headquarters affairs.

NEW PRESIDENT OF SOUTHERN Section, IAEI, J. E. Snakenberg of New Orleans (left) receives Certificate of Merit from Mayor of New Orleans. Retiring IAEI president W. A. Stall makes the presentation at the IAEI Silver Jubilee meeting in Chicago.

Clean!

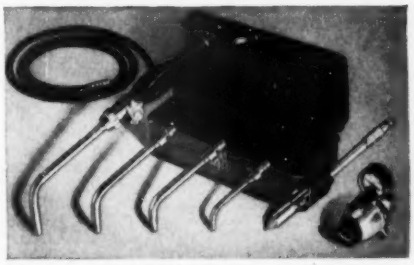
NO SMUDGE

NO CLEANUP

A SAFE SOLDERED JOINT

Prest-O-Lite Trade-Mark 5-in-1 OUTFIT SOLDER-BRAZE

Eliminate time-wasting and costly cleanup with this air-acetylene outfit. Its flame is clean, hot, easy to handle. One flick of the thumb gives instant working heat. No smoke, fumes, soot, or stain. One handy kit takes care of all of your soldering, heating, and light brazing requirements. See your LINDE Jobber today. Or write LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.



Get it from your LINDE jobber.

Four stems and a soldering iron handle every type of work. Fully adjustable pressure regulator permits exact flame adjustment for each soldering job.

The term "Prest-O-Lite" is a registered trade-mark of Union Carbide and Carbon Corporation.

PRECISION Air-Cooled TRANSFORMERS

"Known by the companies we keep selling!"

PARTIAL LIST OF RECENT INSTALLATIONS

- Carbide & Carbon Chemical Co. Oak Ridge, Tenn.
- Ascher Corp. Charleston, So. Carolina
- Reynolds Elec. & Eng. Co. Albuquerque, N. M.
- Chrysler Corp. Indianapolis, Indiana
- National Biscuit Co. Chicago, Illinois
- U. S. Dept. of Interior Bonneville Power Administration Vancouver, Wash.
- Hajoca Corp. Chattanooga, Tenn.
- City of Chicago Chicago, Illinois
- Naval Base Forrest Sherman Field Pensacola, Fla.
- Inland Steel Co. East Chicago, Ind.
- Twin City Arsenal Minneapolis, Minn.
- Ill. Institute of Technology Chicago, Illinois
- Indiana-Kentucky Elec. Corp. Madison, Indiana
- E. C. Ernst & Tuck & Kendall, Inc. Naval Air Station Norfolk, Va.
- Zenith Radio Corp. Chicago, Illinois
- Ford Motor Co. St. Paul, Minn.
- Keystone Mine Crested Butte, Colo.
- Atomic Energy Commission Wilson Dam, Ala.
- Kaiser Engineering Co. Meade, Washington

IMMEDIATE DELIVERY on most sizes of Single & 3-Phase AIR-COOLED TRANSFORMERS

1/4 to 1000 KVA . . . Up to 15,000 Volts

Built to latest N.E.M.A. standards—Class "B" insulation — guaranteed to give long, trouble-free service. CALL, WIRE OR WRITE FOR CATALOGS, PRICE LISTS, OR TO ORDER.

PTC

PRECISION TRANSFORMER CORP.

660 W. Grand Avenue • Chicago 10, Ill. • SEeley 8-2740

BRING YOUR TRANSFORMER PUZZLES TO *Standard*

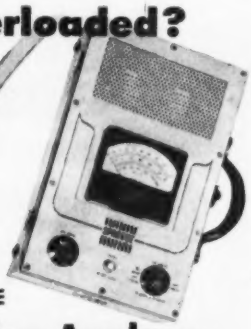
PLANNING A TRANSFORMER INSTALLATION can become quite puzzling. But, the pieces fall easily in place when specially trained, experienced STANDARD engineers are called in and consulted. This service is available to you without cost. Call STANDARD today!

Standard
THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Wiring Overloaded?

CHECK IT!



...WITH THE SPRAGUE

Adequate Wiring Analyzer

This compact Sprague instrument checks wiring to see if it's adequate for present or contemplated loads.

See the effect of increasing loads on wiring *right at the spot!* Direct reading meter indicates percentage voltage drop on 115 or 230 volt circuits under load *without troublesome calculations.*

Connectors for convenience outlets, equipment, panel boards, etc. are furnished—ideal for industrial, utility, and field use.

Write for Bulletin PF-600

SPRAGUE ELECTRIC COMPANY
333 Marshall Street, North Adams, Massachusetts

SPRAGUE
PIONEERS IN ELECTRIC and ELECTRONIC DEVELOPMENT

Please send me the free Sprague catalog "Power Factor Correction" (C-11)

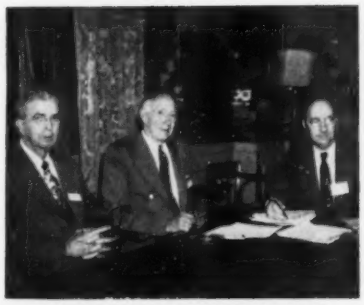
Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

JUST SEND THIS COUPON FOR YOUR COPY



HEADING EASTERN SECTION IAEI activities for 1954 will be (L to R): first vice president—A. O. Hyde, Buffalo, N. Y.; president—F. L. Mattfeld, Albertson, Long Island, N. Y.; secretary-treasurer—J. W. King, Providence, R. I. William Carrol, Brockton, Mass., was elected second vice president of the group.

A women's program included a tour of Duluth's Skyline Drive and other points of interest in the city. At 4 p.m. the women guests joined their husbands for a cruise on a chartered launch in the Duluth-Superior harbor to view the city's ore loading docks and grain elevators. A banquet in the evening concluded the meeting.

• • • •

New England Chapter held its regular meeting at the Hotel Bradford on September 10th. The meeting was called to order by their president, Ed. Kolhonen. Thirty-nine members were present. Dinner was served at 7 p.m. A brief outline on plans for the Northeast Conference to be held next November was given by J. Reddington. Mr. Ray Kutta, guest and a member of Insulation and Wires from Fort Wayne, was called on to give a few brief remarks to the group. Arthur Glines, Chairman of the Program Committee, gave an outline of programs for future meetings.

• • • •

NISA will participate in the Plant Maintenance Show to be held in January in Chicago.

• • • •

Los Angeles Chapter held its regular meeting on Tuesday, October 13th and officers elected for the coming year.

• • • •

J. G. Spaulding 73, Spaulding Electric Co. Detroit, died Sept. 5th of a blood clot shortly after returning to his home from work. Burial was held Sept. 9th in Detroit.

Mr. Spaulding served the electrical industry in various capacities for more than 50 years and was the holder of a NISA 50-year certificate.

• • • •

J. A. Milligan, secretary-treasurer, Smith-Milligan Electric Co., Tulsa, Okla., died Sept. 1st.

MINISTER OF LABOR for the Province of Saskatchewan, Canada, Charles C. Williams addresses the IAEI convention following presentation of a Section Charter to Canadian inspector group.

Fire completely destroyed buildings and equipment of the Sterling Electric Co., Ltd., St. Catharines, Ont., July 27th. Only office records were salvaged.

The company was able to continue operation only because Ampere Electric, Ltd. in the same city turned over a section of its shop and facilities to Sterling employees so work could continue without interruption or inconvenience to customers.

E. A. Dodington of the Sterling firm has acquired new property near the old plant site and expects to reopen in a few weeks.

• • • •

Blue Ridge Electric Service, Winchester, Va. moved June 1st from 1031 Orchard Ave. to a larger building at 1604 S. Loudoun Street.

• • • •

John H. Cole, representative of the Helwig Co. Milwaukee, has moved his

A PRACTICAL APPROACH to the service entrance problem is the six subdivisions of the electrical service, R. A. Millermaster, Cutler-Hammer, Inc., Milwaukee, tells IAEI members as he discusses development of this technique.

For QUICK, EASY, SAFE Cable Installation "EFFICIENCY" NESTED CONDUCTOR RACKS

Efficiency Nested Conductor Racks are simple, compact and are scientifically designed to carry conductors equidistant from center to center. One bolt supports the bushing, and clamps the bushing support to the frame. Available in 2-3-4-5 and 6-bushing racks.

Write for Catalog 38-A

Efficiency ELECTRIC AND MANUFACTURING CO.
MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION
EAST PALESTINE, OHIO
"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

YOUR STAFF IS WHERE YOU FIND IT

Key personnel in any organization leave their desks frequently to keep things moving in other departments of the company. But each member of the group must be within reach at all times since they constitute the chief "players" of the management team.

The Wheelock Code Call makes it possible for the telephone operator to locate someone by merely pressing a button which controls a network of signals throughout plant, factory, or offices. When the employee hears the signal he or she responds via the nearest phone. Thus, instant contact is established and valuable "searching" time is saved.

The Wheelock Code Call is easy to install and various combinations of chimes, bells and horns are available.

Write for Bulletin B4-3

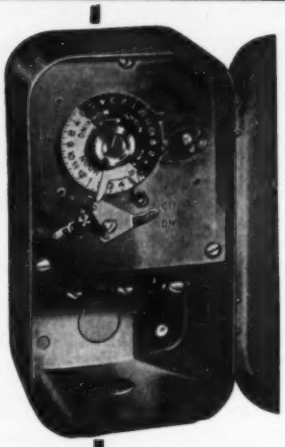
SOLD THROUGH ELECTRICAL WHOLESALERS

Wheelock CODE CALL SIGNAL
ENGINEERING & MFG CO
154 WEST 14TH ST. NEW YORK 11 N.Y.

NEW LOW-COST TIME SWITCH
With Higher-Priced Features

RELIANCE MODEL "400"

Reliance engineering has designed a time switch, with all the dependability and convenience of automatic circuit control, at low cost. The new Reliance Model "400" has the features and quality of many higher-priced switches.



Type 401 S.P.S.T.
20 Amps.—125 Volts

Check These Features

- Precision gear train
- Standard, heavy-duty motor
- Motor gears oil-sealed for lifetime lubrication
- Pit resistant silver-to-silver contacts
- One-piece deep-drawn steel case.

RELIANCE TIME SWITCHES

Send for FREE catalog

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 Mead St. Racine, Wis.

KOHLER
ELECTRIC PLANTS
Independent Source of Electricity

Save with on-the-job electricity

Portable, low-cost model moves jobs faster. Eliminates expense, delays of temporary power-line hook-ups. Operates floodlights, electric saws, drills, other tools having universal (AC-DC) motors. Develops 1500 watts DC. Weighs only 101 lbs. Handle for carrying. Other sizes 500 watts to 30 KW, of various voltages in single and 3-phase models. Stand-by models maintain home, public or commercial electrical equipment when central station power is cut off. Write for folder 4-M.

MODEL 1.5MS, *1500 watts, 115 volt DC. Manual control. Also 115 volt AC, weighing 130 pounds.*

Kohler Co., Kohler, Wisconsin. Established 1873

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

ALL SET FOR opening session of IAEI Convention are Texans (L to R) S. J. Wolfenson, electrical engineer, Brown & Root, Inc., Houston; T. C. Stautberg, chief electrical inspector, Houston; and M. A. Petty, chief electrical inspector of Corpus Christi.

Oklahoma City office to 1825 W. Main St. Oklahoma City.

• • • •

Blair Electric Service Co., Altoona, Pa. has been named a distributor for Allis-Chalmers motors, controls and "Texrope" drive equipment in Bedford, Blair, Centre, Clearfield, Huntingdon and Mifflin counties in Pennsylvania.

• • • •

A three hour fire Aug. 16th at the Roy A. Berentz Co., NISA member in Houston, Tex. caused extensive damage to the company's stock and one story corrugated iron building.

There were no injuries during the blaze which started at 6 a.m. on a Sunday morning. Manager Herbert Stark could not estimate the damage until a survey of destroyed electrical equipment was made.

The firm expected to resume operation last month.

• • • •

The New York Metropolitan Chap-

OKLAHOMA GETS a Charter as a Chapter of the Western Section, IAEI. Glen Holmes (left) chief electrical inspector of Tulsa accepts the charter in behalf of his 25 members from George C. Monroe, Springfield, Mo., representing the Western Section.

ter held its meeting on October 15th at the Hotel Shelburne. Included in the program was presentation of film on metalizing of various jobs by The Metalizing Corporation of America.

Final preparations were made for Ladies Night which will be held on October 29th. This will be the second affair of this kind undertaken by the Metropolitan Chapter, and a much larger and more interesting program is anticipated. Alex Shovan presided at this meeting.

F. W. Langley of F. W. Langley Ltd., Electrical & Mechanical Engineers, Stoke-on-Trent, England visited New York in October. Mr. Langley is Managing Director of a large electrical organization in England employing over 150 employees and engaged in repair and manufacture of electrical equipment. He visited the following shops: The Maintenance Company, Inc., Electrical Enterprise Co., Consolidated Electric Motor Co., Premier Electric & Engineering Co., and Brownell Distributors, Inc.

From Walter J. Prise, The Maintenance Company, Inc., New York, N. Y.

DATES AHEAD

National Electrical Contractors Association—Annual convention, Miami Beach, Florida, November 17-20.

National Rural Electric Cooperative Assn.—National convention, Miami, Florida, Jan. 11-14, 1954.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 8-12.

Plant Maintenance & Engineering Show—Exhibits International Amphitheatre, Conferences Hotel Conrad Hilton, Chicago, Ill., January 25-28.

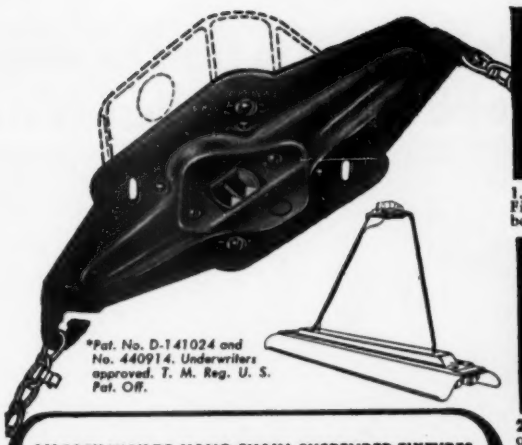
Power and Communication Contractors Association — Ninth Annual convention, Edgewater Beach Hotel, Chicago, Ill., March 8-11.

Illuminating Engineering Society — Regional Conferences: Southern — Roosevelt Hotel, New Orleans, La., April 8-9; Southwestern—Rice Hotel, Houston, Texas, April 11-13; Inter-Mountain — Denver, Colo., April 15-16; South Pacific Coast—Museum of Art, San Francisco, April 19-20; Pacific Northwest—Benjamin Franklin Hotel, Seattle, Wash., April 22-23; Canadian—King Edward Hotel, Toronto, Ont., Canada, April 28-30; Great Lakes—Sheraton-Cadillac Hotel, Detroit, Mich., May 3-4; Midwestern — Jefferson Hotel, St. Louis, Mo., June 17-19.

American Society of Tool Engineers' Industrial Exposition — Convention Center, Philadelphia, Pa., April 26-30.

National Fire Protection Association—58th annual meeting, Statler Hotel, Washington, D. C., May 17-21.

National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., Week of June 6.



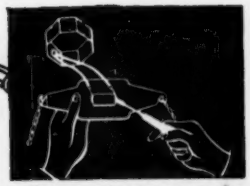
AN EASY WAY TO HANG CHAIN-SUSPENDED FIXTURES IN LESS TIME...AT LESS COST...WITH LESS WORK WITH

HYDEE HANGER*

"DECIDEDLY BETTER"

DAY-BRITE Lighting Fixtures

01



1. Connect wires to receptacle. Fits standard 4" or 3¼" outlet box or plaster ring.

2. Screw hanger to outlet box—only two screws needed. No centering, punching, or drilling. Screwdriver only tool needed.

3. Hang the fixture and plug it in. That's all! Self-grounding—regular 2-wire cord and plug may be used.

Hydee Hanger, complete with receptacle, two 3-ft. chains, "S" hooks and clips—

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo.
In Canada: Amalgamated Elec. Corp., Ltd., Toronto 6, Ontario

DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

"WOW! I drilled a 1-inch hole through 6 inches of hard concrete in 1 minute with a Cyclo-Core drill bit!"

CARBIDE-TIPPED BITS

FOR DRILLING HOLES ⅛" TO 6" DIAMETER IN

TILE · BRICK · CONCRETE · GRANITE

or ANY other Masonry Material

Time is Profit when you use these easier, faster drilling bits for any masonry job — any size hole, any depth, any material from soft brick to hard concrete and granite. The New England Carbide Masonry Bit size-range — Cyclo-twist — Cyclo-Core — Thunder-twist — Thunder-Core — is the world's only complete line. Your dealer has them or can easily get them for you.

Mail the Coupon for Free Copy of

"MASONRY DRILL BIT GUIDE" — full information on how to select the right bit for every power tool and every masonry material.

NEW ENGLAND CARBIDE TOOL CO., INC., Cambridge 39, Mass.

New England Carbide Tool Co., Inc., 60L Brookline St., Cambridge 39, Mass.
Gentlemen: Please send by return mail the free "Masonry Drill Bit Guide".

Name .....

Address .....

My Local Dealer's Name is: .....

A Journeyman's Tool, built to stand up under constant, on-the-job Contractor or Industrial use

...with built-in blower
RCS
SUPER SAW
AIR COOLED
Saves more time than any tool in your kit.
Fits any heavy duty ¼" drill—saws any material.

● **NO STARTING HOLE NEEDED**...Simply place guide next to material and "rock" tool into an upright position.

● **CUTS RIGHT THRU IMBEDDED NAILS** . . . wood, plaster, iron pipe, sheet metal, "Transite" and most other materials—even in cramped quarters.

● **FITS ANY HEAVY DUTY ¼" or ⅜" DRILL**...as easy as changing bits! Overall length only 10¾"; weight only 3 lbs. 6 ozs.

● **ANTI-FRICTION REPLACEABLE BEARINGS—BUILT-IN BLOWER** . . . Blower keeps tool comfortably cool even under continuous use—blows dust and chips away from cutting line. All friction surfaces are of "Oilite," phosphor bronze or high speed ball bearings. All wearing parts are replaceable.

Write for Bulletin No. Y-11.

Cutting opening in oak flooring in less than 3 minutes—no starting hole needed!

R.C.S. TOOL SALES CORPORATION Joliet, Illinois, U. S. A.

Among the Manufacturers

Headquarters Announcement

General Electric Co., Schenectady, N. Y.—James P. Dempsey, manager of employee and plant community relations, Welding Dept., York, Pa.; Edward K. How, manager of Sales, Welding Dept.; Aaron M. Krakower, manager of electronic and high voltage transformer sales, Specialty Transformer Dept.; Arthur E. Rowe, manager of sales, Ballast Dept.; Paul R. Hartig, manager of employee and community relations, Pittsfield, Mass., Works; Dr. Louis T. Rader, general manager, Specialty Controls Dept.; J. Stuart Franklin, supervisor, Lighting and Rectifier Dept. Photometric Laboratory, Lynn, Mass.; Vincent P. Gregg, product planner, Specialty Motor Dept.

Tinnerman Products, Inc., Cleveland, Ohio—A. H. Tinnerman, Chairman of the Board; George J. Schad, president; Lawrence H. Flora, director of sales; Edward E. Griger, sales manager; William L. Seitz, chief engineer; John Balint, new product manager.

Apex Electrical Mfg. Co., Apex Roarex Corp., Cleveland, Ohio—Harold P. Bull, general sales manager.

Duro-Test Corporation, North Bergen, N. J.—Harold C. Slane, vice president.

Weston Electrical Instrument Corp., Newark, N. J.—Charles B. Denton, marketing manager.

Square D Company, Detroit, Mich.—James F. Magin, vice president.

Century Lighting Inc., New York City, N. Y.—Rollo Gillespie Williams, color lighting consultant, Sales Engineering Div.

Bristol Company, Waterbury, Conn.—Ernest Nuber, sales manager, Instrument Division.

General Electric Co., Industrial Power Components Div., San Francisco, Calif.—Robert L. Brownlee, plant manager, Distribution Assemblies Dept.

Leadlight Fixture Co., Oakland, Calif.—John S. Kinnaird, sales manager.

General Electric Co., Plainville, Conn.—Elmer T. Carlson, general manager, Distribution Assemblies Dept.; Hershner Cross, general manager, Trumbull Components Dept.

Hyster Company, Portland, Oregon—James L. Woodley, general service manager.

Electric Storage Battery Co., Phila., Pa.—Roland Whitehurst, general manager, Industrial Products Div.

Insulation Manufacturers Corp., Chicago, Ill.—J. Harold Martin, assistant vice president; Paul K. Wolfram, sales manager, Cleveland Merchandising Division.

Raytheon Manufacturing Co., Waltham, Mass.—Ashley A. Farrar, assistant vice president.

Westinghouse Electric Corp., Pittsburgh, Pa.—Frank L. Snyder, manager, Transformer Div., Sharon, Pa.

General Electric Co., Bloomfield, N. J.—Robert P. Allison, manufacturing consultant, Weathertron Dept.

Regional Appointments

NEW ENGLAND

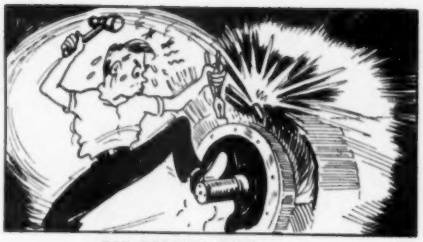
Westinghouse Electric Corp., Northeastern Region: C. S. Purnell, regional electric utility manager; K. L. Horgan, industrial manager; J. C. Frink, manager, transportation, marine and aviation dept.; F. G. Graf, agency and construction manager; H. R. Benson, maintenance manager; M. L. Gardner, engineering and service manager; E. W. Seay, application data and training manager; R. L. Sutton, market planning supervisor; J. H. Rothermel, assistant manager; E. C. Delano, manager, Boston District; E. C. Horton, manager, Connecticut Valley District.

MIDDLE ATLANTIC

General Electric Co.: Albert L. Baldock, manager, Ea tern Sales District, office in New York City.

Westinghouse Electric Corp.: W. C. Wood, manager, Newark District; H. E. Dralle, manager, New York City District; H. B. Vidal, manager, New York State District, office in Buffalo, N. Y.

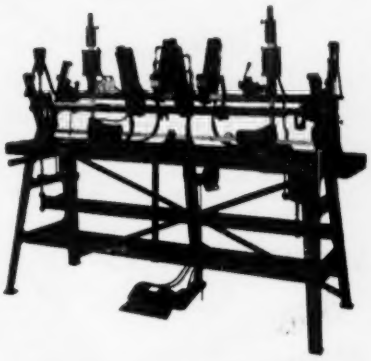
REVERSE PROCEDURE finds retiring IAEI president W. A. Stall (right) on the receiving end of a gift presentation at the concluding session of the IAEI Silver Jubilee meeting in Chicago. R. E. Ward (left), retiring Southern Section president, does the honors.



FOR PROFIT'S SAKE MODERNIZE NOW!

DON'T TRY TO MAKE OUT WITH OLD OUT-DATED EQUIPMENT!

NEW FULLY AIR OPERATED P & R COIL SPREADER . . . YOUR COILS FIT THE JOB!



★ Saves up to 50% Spreading & Winding Time

★ You Cut Operator Fatigue Permanently — Easily Adjusted and Operated

★ New Air Operated Coil Holders and Knuckle Kick-Ups for Long, Simple and Trouble-Free Operation

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Prevent Costly Burnouts

with VAP-OIL-TITE FITTINGS

Fouled contacts cause costly burnouts and down-time. Use VAP-OIL-TITE FITTINGS with Plastic Covered Flexible Metallic Conduit for Sure Sealing of wiring on oil, water, dust and vapor tite equipment.

VAP-OIL-TITE'S exclusive threaded bushing not only insures positive grounding but also makes fitting easier to install because a collar covers metal edges making burring unnecessary. Furnished in numerous types with body sizes from 3/8" to 2". Write or wire today for bulletin #MT-104 giving types, sizes and prices.

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MEANS SMOOTHER OPERATION
LONGER WEAR
Exploded View of Joint
#259P 6",7",8". Also with splicing grooves, #259S
SPECIAL HANDLES
UTICA lineman's pliers can be supplied with heavy, black rubber vulcanized handles. Designed for comfortable grip, long wear and protection.
Send for booklet describing UTICA's complete line of LUBRING® Pliers.
UTICA Lubring®-the pliers that oil themselves! Porous iron lubricating ring "floats" in the joint, absorbs lubricant and feeds it as required. Keeps joint smooth and free-working. There are no finer lineman's pliers than these patented and exclusive UTICA heavy duty Lubrings.®
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It pays to use quality tools
and the world's best tools are made in U.S.A.
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The names UTICA (when referring to the line of hand tools) and LUBRING are trade marks registered in U.S. Patent Office.

For a Fast, Tight Tap That Will Never Freeze

Specify

KEARNEY PROTECTED THREAD CON-NEC-TAP CLAMPS

Months or years later, they're just as easy to take off as they were to tap on. You'll save by being able to use them again and again. The Con-nec-tap's tightening threads are kept corrosion-free in a lubricated, waterproof chamber. A heavy Duronze spring washer keeps it permanently tight on the conductor despite expansion, contraction or vibration.

Con-nec-tap live-line clamps are made in a complete series for aluminum-to-aluminum taps, as well as a complete series for aluminum-to-copper connections.

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For Better Construction-For Safer Maintenance

SOUTH ATLANTIC

Jefferson Electric Co.: John G. Stanwood, regional field representative, Baltimore area.

Rhode Island Insulated Wire Co., Inc.: Donald Reiman, Southern District Manager, office in Atlanta, Ga.

EAST CENTRAL

Precision Transformer Corp.: C. W. Bates, sales representative, Michigan area, office in Detroit.

General Electric Co.: Constantine L. Chase, manager, Mid-Western Sales District, office in Cleveland, Ohio.

Line Material Co.: Joe N. Drew, field engineer, South Central Division.

Sterling Electric Motors, Inc.: John F. Curd, district manager, Cincinnati District office.

Remington Corporation: Ronald H. Pepin, sales representative for Michigan, Ohio and Western Pennsylvania.

WEST CENTRAL

Remington Corporation: E. G. Sommerlath Jr., sales representative for Kansas, Missouri and Southern Illinois.

WEST

Toledo Pipe Threading Machine Co.: Marvin V. Cox, representative in Southern California, Arizona and New Mexico, office in Huntington Park, Calif.

Graybar Electric Co.: J. H. Gregerson, manager, and R. P. Sager, operating manager, new San Bernardino, Calif., office.

Precision Transformer Corp.: Edward T. Mug, sales representative for Colorado, New Mexico and Wyoming, office in Denver.

CHIEF ELECTRICAL INSPECTOR A. H. Welklin, Fort Wayne, Ind., shows some of the material on electrical safety available through the IAEI public relations committee of which he is chairman. Display appeared at IAEI Silver Jubilee meeting in Chicago.

BUSINESS OUTLOOK

[FROM PAGE 91]

would not have been sold. The fact is that there is a great deal of capital planning going on which ignores the short-run outlook in favor of the bright prospects for long-term growth.

The Long Way

We wish we knew whether the long-term planners operate in water-tight compartments which separate them from the stock market operators, the inventory planners, etc. It seems unlikely that this is so, in view of the popularity of such effective procedures for exchanging business information as the long luncheon and the cocktail hour. But we have often observed that company officials who are pessimistic—about the stock market, business, and even their own short-run sales outlook—have no difficulty in shutting out gloomy visions when they talk about new plant construction and how it will improve their competitive position by 1955 or 1960.

One reason for the mixture of long-term optimism with short-term pessimism is the fact that much industrial investment is necessarily tied to a long-term growth curve. This holds true for electric and gas utilities, telephone, petroleum refining, food processing and many chemical companies. And even in such established industries as steel or automobiles, capital expenditures are likely to be made—despite the short-term outlook—as long as the research scientists keep coming up with startling developments like continuous casting for steel ingots, or automatic machining for automobile engine blocks. In fact, we suspect that if we can just keep the pessimists away from the research departments, we may have a good part

CHECKING INSTALLATION details of electrical system for Detroit's new City-County Building are: H. O. Krippendorf (left), vice president; and John S. Mahoney, job superintendent of Harlan Electric Company, project electrical contractors.

drills 6 inches of concrete per minute
...gives lowest cost per foot of concrete drilled with a
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KONKRETE KORE DRILL
Patented core slot expels cuttings automatically
U. S. Pat. No. Re. 23539
Drill straight, clean, ready-to-use holes at speeds up to 6 inches per minute—even through steel reinforced concrete.
TILDEN Rotary Koncrete Kore Drills can be used with ordinary electric or rotary air drill. Free Factory sharpening and repair service still available on all Standard TILDEN Drills from 3/16" to 8-inch diameters interchangeable shanks for any depth hole.
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SOLD BY SUPPLY HOUSES EVERY-WHERE
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Revere
ELECTRIC MFG. CO. CHICAGO, U.S.A.
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GIVES YOU A MULTITUDE OF COMBINATIONS
BAR HOLDER MOUNTED HORIZONTALLY
Write for BULLETIN XX-10
Since the introduction of Cluster Lights by REVERE a score or more years ago this type of lighting has literally penetrated all fields. One latest contribution is the Bar-Type Holder which permits every combination of Cluster Mounting imaginable.
Two sizes are available—one Holder with 7 outlets and one Holder with 13 outlets, offering unusual possibilities for lighting used car lots, golf driving ranges, carnivals, playgrounds, gas stations, factory yards, etc.
BAR HOLDER MOUNTED VERTICALLY
REVERE ELECTRIC MFG. CO. 6017 BROADWAY CHICAGO 40, ILL.
INDOOR & OUTDOOR LIGHTING FOR EVERY NEED
THE REVERE LINE OF FLOODLIGHTS IS COMPLETE
ELIPTUR 300 to 1500 WATT
18 and 20 in. REAR SERVICE FLOODS
"ENDOVAL" MERCURY VAPOR LUMINAIRE
300 to 1000 WATT ENCLOSED FLOODS
AREA LIGHTER WITH TOP FLOODS

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS

Here are thousands of facts and figures, systems and measurements, methods and materials from all fields of electrical engineering. This handbook covers everything from electric and magnetic circuits, regulators and reactors, and prime movers . . . to illumination, power system electrical equipment, and electronics and electron tubes. Prepared by a staff of specialists. **A. Knowlton, Electrical World, Editor-in-Chief. 8th Edit., 2311 pages, 1961 illus. $17.00**

AMERICAN ELECTRICIAN'S HANDBOOK

Gives proven, ready-to-use facts on efficient selection, installation, operation, care, and application of electrical apparatus and materials. Contains complete data on wires and cables, splicing, capacitors, lighting equipment—together with advances in electronic tubes and circuits, and their uses in industry. Completely in line with current National Electrical Code. Presents the kind of facts that help all practical electrical men—thoroughly indexed for quick location. **By Terrell Croft. Consult. Eng. Revised by Clifford C. Carr. 7th Ed. 1734 pages, 1327 illus., over 400 tables. $10.00**

NATIONAL ELECTRICAL CODE HANDBOOK

Helps electricians understand and work in accordance with the 1951 National Electrical Code. Covers all code requirements, gives rules in simple language—supplies explanations, practical directions, and diagrams that show what the rules mean and how to apply them. Motor wiring and other tables are given in the final chapter. **By Arthur L. Abbott. 7th Ed. 646 pages, 430 illus. $7.00**

HANDBOOK OF INDUSTRIAL ELECTRONIC CIRCUITS

Reference manual on 433 industrial electronic circuits for immediate practical use. For each circuit there is a clearly drawn diagram along with a brief yet comprehensive description—how it works, performance characteristics, applications, etc. Values of all the important components are given to facilitate conversion of the theoretical circuit to actual practice. Contains all types of circuits, from counting to welding control, both simple and advanced. Brings you hundreds of war-developed industrial circuits. **By John Markus, Associate Editor, and Vin Zeluff, Managing Editor of Electronics. 272 pages, 433 diagrams. $7.50**

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This offer applies to U. S. only.

of the problem of maintaining a high level of prosperity solved.

The Hard Sell

In the consumer goods field, this is the start of a tremendous selling season. We can report with some authority that such matters as long-term cycles or technological revolutions are still receiving very litle attention on Seventh Avenue. But when it comes to such simple matters as hitting the customer over the head to make a sale, the boys are in there swinging this season. *Both sales and production of apparel and other soft goods are at* ***very high*** *levels. And some cotton textile makers are already booked well into 1954.*

The makers of such consumer durables as television sets and household appliances are also starting energetic sales campaigns, designed to promote the usual fall upswing in retail sales. Production schedules are up, despite what appear to be relatively high inventories of this sort of merchandise. Total department store stocks of all goods on hand and on order are now larger than at any time since 1951.

The coming months may offer a chance to prove the thesis that a generous dose of salesmanship in promoting consumer goods serves a useful economic purpose. Recent slowness in department store sales may be due to a combination of holidays and unfavorable weather. But a massive sales effort clearly will be necessary to achieve the sort of increase manufacturers are counting on.

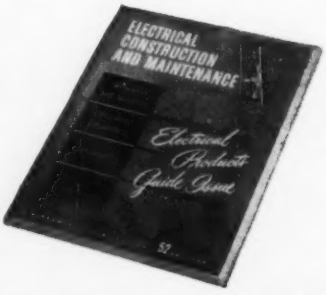
We rather enjoy the speculation that the future is largely in the hands of the researchers and the salesmen. This suggests that, while 1953 may be the biggest business year for some time, 1954 may turn out to be the most interesting.

CORNER CONFAB between officers of the Northwestern Section, IAEI, at inspectors' Silver Jubilee meeting in Chicago. They are (L to R): first vice president—J. C. Hewitt, Olympia, Wash.; president—J. R. Crawford, Butte, Montana; second vice president—Cliff Atkins, Portland, Oregon. W. L. Gaffney, Tacoma, is secretary-treasurer.

If finding a **product** has you lost at sea—

You'll find your way fast in the EPG

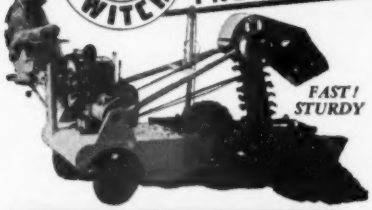
You'll find verified manufacturers of more than 1,500 products in the PRODUCT DIRECTORY (Pages 139-254) of the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.



. . and for product data that fits to a tee, Just refer to the ads in the EPG

ELECTRICAL CONSTRUCTION AND MAINTENANCE

DITCH WITCH World's Best SMALL TRENCHER



4 DITCH-WITCH Models
Digs 2" to 6" Trenches
Any Depth to 36"

A self-contained ditcher operating under its own power—digs clean even 2" to 6" trenches to a 36" depth. Light weight, mobile, low operating and maintenance costs.

DITCH-WITCH used in these Industries: Construction, Maintenance, Petroleum, Railroad, Electrical, Plumbing, Municipal

PROVED IN ALL SOILS

DITCH-WITCH digs as many feet of trench as machines four times its size. Pays for itself in a few days.

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THE CHARLES MACHINE WORKS
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MINERALLAC
"PULL-IN"
COMPOUND
No. 100

LISTED and APPROVED by UNDERWRITERS LABORATORIES

For Rubber, Synthetic, Plastic or Lead-Covered Wires or Cables

Approved by Underwriters Laboratories for lubricating wires and cables to facilitate pulling them into conduits. Not injurious to wire or wire covers. Free of objectionable odors. White in color. Will not drip or run. Convenient pint, quart, ½ gal., gal. and 5 gal. cans. Available through your electrical jobber.

MINERALLAC ELECTRIC COMPANY
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MINERALLAC

ELECTRICAL INSTALLATIONS IN THE PETROCHEMICAL INDUSTRY

[FROM PAGE 90]

hazardous locations is usually labeled to show the approval for its respective class and group. Labels are provided by testing agencies such as the U. S. Bureau of Mines, Underwriters' Laboratories, Inc., after the equipment has been subjected to standardized tests and found acceptable. Underwriters' Laboratories, Inc., publishes a book, *Hazardous Location Electrical Equipment List*, which lists all acceptable equipment available for hazardous location duty. Figs. 1, 6 and 7 show typical explosion-proof equipment. Although this equipment is approved for indoor use only, much of it is being installed outdoors, and electrical inspectors have approved both the thread and flat joint type of equipment for outdoor use. Since the flat joint type does not stand up as well outdoors as the threaded type, many inspectors are now approving only the latter.

Although a practically complete line of fittings, materials and equipment is available for Class I, Groups C and D locations, very little is approved for Groups A and B. It is therefore generally desirable to locate electrical equipment outside of such areas wherever possible. Specific restrictions are placed by the National Electrical Code on the installation of transformers, motors, generators, lighting units, etc., and the particular article dealing with the specific equipment involved should be consulted before installation plans are made.

THIRD PRIZE in "My Most Interesting Lighting Job" contest sponsored by IES went to Mario G. Zervigon (left), awarded by Pres. Everett M. Strong during IES National Technical Conference in New York, Sept. 14-17. In background looking on is Henry Koether, Wisconsin Electric Power Co., Milwaukee, Nick Stuffer, Westinghouse Electric Corp., Cleveland, both winners in same contest, and Lee E. Tayler, Detroit Edison Co., chairman of the IES contest.

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Production line heating tunnels and banks can be easily made right on the job with versatile Chromalox Electric Heaters for drying, baking, dehydrating, curing and other applications. Quickly and easily installed units allow you to "dial" the exact temperatures you require every time—all the time! All-metal construction insures against damage from shock, hard knocks, water, etc., and eliminates contamination hazards.

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A life-time Yardlight. Modern design—one-piece heavy gauge steel finished with three coats of Vitreous Porcelain Enamel. Completely wired and assembled. Listed by U. L.—approved for N. E. A. installation. Send for catalog.

4-light Infra-Red BROODER for farm or broiler plant

Brooding capacity 20 sq. ft. — accommodates 300 to 350 chicks. Water thermostat automatically controls two of four lamps and can be adjusted to regulate temperature so that lamps burn as needed. 18" dia. steel Reflector — Infra-Red Baked Enamel finish — 6 ft. approved cord and plug — completely wired, ready to install.

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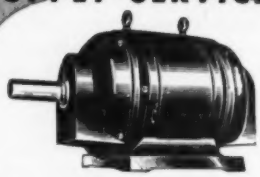

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Next time you need motors from 1/100 to 60 HP., and other electrical items—save time and money—order from your Grainger Motor Book. You'll get fast shipping and pick-up service from your nearby Grainger Warehouse — and lowest possible prices always. Your Grainger Salesman is at your service too—let him help you. Grainger service can help you build sales—it has for thousands of dealers.

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46 WAREHOUSES—COAST TO COAST—SEE PHONE BOOK
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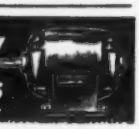
We'll give you quick delivery and lowest prices



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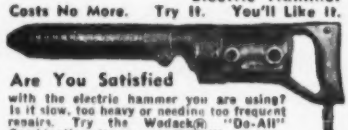

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Address copy to the Classified Advertising Division
Electrical Construction & Maintenance
330 West 42nd St., New York 36, N. Y.

UPRATING HORSEPOWER WITH SILICONE INSULATION

[FROM PAGE 73]

to Class H insulation, this manufacturer's requirements for portable 300 kw generating units were economically and practically met. These units met all the required performance specifications after the 50% increase in rating.

Another interesting case in point involves a Class A insulated, 150 horsepower, wound rotor induction motor. The plant engineering staff felt that if output from this motor could be stepped up, considerable production economies could be gained. They asked one of the local motor repair shops to guarantee a 230 horsepower rating for this motor using Class H insulation. The motor repair company did accept the job under these specifications. This motor has been in operation for three years now delivering a minimum output of 230 horsepower and handling frequent overloads up to 300 horsepower. Shortly after this motor went in service with Class H insulation, it threw a rotor band because a workman in the shop had used a standard lead-tin solder. No damage was done to the winding, however, and it was a relatively simple matter to install new bands using high temperature solder. No other troubles have been encountered on this unit even though it is operating continually with more than a 50% overload based on its Class A insulation rating.

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(My Commission expires March 30, 1954)

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Advertising In This Issue

ADALET MFG. CO., THE 240
●ADAM ELECTRIC CO., FRANK 10
●ALL-STEEL EQUIPMENT, INC 14
ALLEN-BRADLEY CO 225, 226
ALLIS CO., THE, LOUIS 182
ALLIS-CHALMERS MFG. CO 5, 11, 58, 59
ALTER CO., THE HARRY 274
ALUMINUM CO. OF AMERICA 118, 119
●AMERICAN BRASS CO., THE AMERICAN METAL HOSE BRANCH 120
AMERICAN ELECTRICAL HEATER CO 121
AMERICAN TEL. & TEL. CO 211
AMPLEX CORP 189
ANCHOR MFG. CO 125
ANACONDA WIRE & CABLE CO 123
APPLETON ELECTRIC CO 2, 124
ARROW-HART & HEGEMAN ELEC. CO 243, 244
ART METAL CO., THE 238, 239
AUTH ELECTRIC CO., INC 128

BELDEN MFG. CO 218
BELL TELEPHONE SYSTEM 211
BENJAMIN ELECTRIC MFG. CO., THE 236
●BERNZ CO., INC., OTTO 256
BIDDLE CO., JAMES G 109
BLACK & DECKER MFG. CO., THE 178
BLACKBURN CORP., JASPER 15
BLACKHAWK MFG. CO 209
BRIEGEL METHOD TOOL CO 46
BROWN COMPANY 127
BRUSHMASTER SAW, INC 262
BRYANT ELEC. CO., THE 40
●BUFFALO FORGE CO 214
BULLDOG ELECTRIC PRODUCTS CO 19
●BURNDY ENGINEERING CO 129
BUSSMANN MFG. CO 130, 131

CENTURY ELECTRIC CO 37
CHARLES MACHINE WORKS, THE 273
CLARK CONTROLLER CO., THE 27
●COLUMBIA CABLE & ELECTRIC CORP 25
COLUMBIA ELECTRIC MFG. CO 260
COMPLETE-READING ELEC., CO. INC 268
●COPE, INC., T. J 213
CORNING GLASS WORKS 221
●CRESCENT INS. WIRE & CABLE CO 134
●CROUSE-HINDS CO 28, 29
CROWN INDUSTRIAL PRODUCTS CO 204
CUTLER-HAMMER, INC 247

●DAY-BRITE LIGHTING, INC 227, 267
●DELCO PRODUCTS DIVISION OF GENERAL MOTORS CORP 251
●DOW CORNING CORP 50
DU PONT DE NEMOURS & CO., INC. E. I 53

ECONOMY FUSE & MFG. CO 135
EDWARDS CO., INC 136
EFFIENCY ELECTRIC & MFG. CO 265
ELECTRIC SERVICE MFG. CO 23
ELECTRIC STORAGE BATTERY CO., THE 232, 233
ELECTRICAL FITTINGS CORP 224
ELECTRO DYNAMIC DIV. OF GENERAL DYNAMICS CORP 254
ELECTROMODE CORP 197
ERIE ELECTRIC CO., INC 222

FAIRBANKS, MORSE & CO 45
●FEDERAL ELECTRIC PRODUCTS CO 6, 64
●FEEDRAIL CORP 137
FULLMAN MFG. CO 220

●G & W ELECTRIC SPECIALTY CO 138
●GARDEN CITY PLATING & MFG. CO 259
●GEDNEY ELECTRIC CO 32
GENERAL CABLE CORP 139
●GENERAL ELECTRIC CO. APPARATUS DEPT ..... Second Cover 12, 13, 18, 20, 21, 24, 44, 52, 202, 203
●GENERAL ELECTRIC CO., CONSTRUCTION MATERIALS DEPT ..... Fourth Cover, 190
GENERAL ELECTRIC CO., LAMP DEPT 230
GENERAL SWITCH CORP 257
GRAINGER, INC., W. W 274
●GRAYBAR ELECTRIC CO., INC 66
GREENLEE TOOL CO 142
●GUTH CO., EDWIN F., THE 22

HAYNES PRODUCTS CO 274
HAZARD INSULATED WIRE WORKS 143
HEINEMANN ELECTRIC CO 261
●HENDERSON-HAZEL CORP 188

●IDEAL INDUSTRIES 145
ILG ELECTRIC VENTILATING CO 144
●INTERNATIONAL REGISTER CO 146
IRVINGTON VARNISH & INSULATOR CO 184
●I-T-E CIRCUIT BREAKER CO 54, 55

●JACKSON ELECTRICAL CO 274
JOSLYN MFG. AND SUPPLY CO 147
JOY MFG. CO 262

KAISER ALUMINUM & CHEMICAL SALES, INC 151
KEARNEY CORP., JAMES R 270
●KILLARK ELECTRIC MFG. CO 48
KLEIN & SONS, MATHIAS 212
KOHLER CO 266
KRUEGER & HUDEPOHL 256

●LEVITON MFG. CO 235
●LINDE AIR PROD. CO., THE UNIT OF UNION CARBIDE & CARBON CORP 263
LITECONTROL CORP 42

MAGNATRAN, INC 260
MARCUS TRANSFORMER CO., INC 200
●MARTINDALE ELEC. CO., THE 110
●McGILL MFG. CO., INC 223
McGRAW-HILL BOOK CO 272
●MIDWEST ELECTRIC MFG. CO 194
●MINERALLAC ELECTRIC CO 273
MINNESOTA MINING & MFG. CO 33
MOLONEY ELECTRIC CO 16
MONARCH FUSE CO., LTD 208
MULTI-AMP CORP 153
●MURRAY MFG. CORP 1

NATIONAL CARBON CO 152
●NATIONAL ELECTRIC PRODUCTS CORP 60
NATVAR ORP 36, 155
NEW ENGLAND CARBIDE TOOL CO., INC 267
NEWMAN INDUSTRIAL (AMERICA) INC 187

●OKONITE CO., THE 143
OLIVER IRON AND STEEL CORP 156
ONAN & SONS INC., D. W 180
●O. Z. ELECTRICAL MFG. CO., INC 157

●PARAGON ELECTRIC CO 201
PARANITE WIRE & CABLE DIVISION ESSEX WIRE CORP 49
●PASS & SEYMOUR, INC 51, 199
●PENN-UNION ELECTRIC CORP 7
●PHELPS DODGE COPPER PRODUCTS CORP 8, 9
PLYMOUTH RUBBER CO., INC 158
●PORCELAIN PRODUCTS, INC 159
●PORTABLE ELECTRIC TOOLS, INC 249
POTTER & RAYFIELD, INC 269
●PRECISION TRANSFORMER CORP 263
PRESCOLITE MFG. CORP 113
PYLE-NATIONAL CO., THE 228
PYRAMID INSTRUMENT CORP 112

RADIANT LAMP CORPORATION 242
RAMSET FASTENERS, INC 35
RAWLPLUG CO., INC., THE 215
R. C. S. TOOL SALES CORP 268
●RELIANCE AUTOMATIC LIGHTING CO 266
REMINGTON ARMS CO., INC 253
REPUBLIC STEEL CORP 148, 149
REVERE ELECTRIC MFG. CO 271
●RHODE ISLAND INSULATED WIRE CO., INC 57
RIDGE TOOL CO., THE 186, 258
ROCKBESTOS PRODUCTS CORP 160
ROEBLING'S SONS CORP., JOHN A 107
●ROME CABLE CORP 47
ROYAL ELECTRIC CO., INC 252
●RUSSELL & STOLL COMPANY, INC 161

S & C ELECTRIC CO 41
SANGAMO ELECTRIC CO 163
SCHEAR CO., INC., GEORGE 256
●SIGNAL ENGINEERING & MFG. CO 265
SIMPLET ELECTRIC CO 269
SIMPLEX WIRE & CABLE CO 43
SMITHCRAFT LIGHTING DIVISION 62
SNAP-ON TOOLS CORP 206
●SORGEL ELECTRIC CO 176
SPANG-CHALFANT (DIV. OF THE NATIONAL SUPPLY CO.) 164
SPERTI FARADAY, INC 165
SPRAGUE ELECTRIC CO 264
SQUARE D COMPANY ..... Third Cover, 31
●STANDARD TRANSFORMER CO., THE 264
STEEL CITY ELECTRIC CO 166
STEEL & TUBES DIVISION 148, 149
STERLING ELECTRIC MOTORS 108
SUPERIOR ELECTRIC CO., THE 179
●SYLVANIA ELEC. PRODUCTS, INC 30

TAL BENDER, INC 181
THOMAS & BETTS CO., THE 169
THOMPSON ELECTRIC CO., THE 196
●TILDEN TOOL MFG. CO 271
TITCHENER & CO., E. H 198
TOLEDO PIPE THREADING MACH. CO., THE 210
●TRIANGLE CONDUIT & CABLE CO., INC 26
TRUMBULL DEPT., GENERAL ELECTRIC CO 205

●UNION CARBIDE & CARBON CORP., THE LINDE AIR PROD. CO. UNIT 263
●UNITED STATES RUBBER CO 17, 111
UP-RIGHT SCAFFOLDS 34
UTICA DROP & FORGE TOOL CORP 270

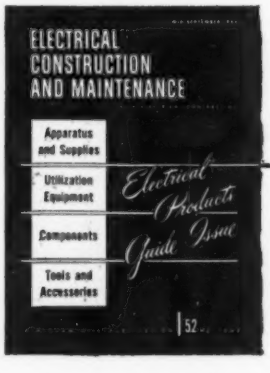
VAN CLEEF BROS., INC 255

●WAGNER ELECTRIC CORP 56, 207
●WAGNER MALLEABLE PRODUCTS CO 171
WAKEFIELD BRASS CO., F. W., THE 241
WEAVER CO., J. A 172
●WESTERN INSULATED WIRE CO 250
WESTINGHOUSE ELECTRIC CORP. (LAMP DIVISION) 167
WESTINGHOUSE ELECTRIC CORP. PITTSBURGH 38, 39, 122, 126, 140, 141, 150, 154, 162, 170, 216, 217
●WESTINGHOUSE ELECTRIC SUPPLY CO 115, 116, 117, 132, 174
WHERE TO BUY 274
●WIEGAND CO., EDWIN L 273
WIREMOLD COMPANY, THE 168
WODACK ELECTRIC TOOL CORP 274

YOUNGSTOWN SHEET & TUBE CO., THE 173

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 275
EDUCATIONAL
Books 275
BUSINESS OPPORTUNITIES
Offered 275
NOTICES
Legal 275
EQUIPMENT
(Used or Surplus New)
For Sale 275
WANTED
Equipment 275



• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the Index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

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